

# Environmental Technologies for the Nonferrous Metals Mining Industry

*A Sourcebook of U.S. Suppliers of  
Pollution Prevention and Control Technologies  
for the Mining Industry*

August 1999



Sponsored by  
U.S. Agency for International Development



# **TECNOLOGIAS AMBIENTALES PARA LA MINERIA DE METALES NO FERROSOS**

## **LIBRO DE REFERENCIA**

UNA GUIA DE PROVEEDORES NORTEAMERICANOS DE TECNOLOGIA PARA LA  
PREVENCION Y EL CONTROL DE LA CONTAMINACION EN EL SECTOR MINERO

**Una guía tecnológica complementaria a**  
*Las Mejores Prácticas Gerenciales en Minería y Procesamiento de Metales No Ferrosos*

### **PREPARADO PARA EL USAID POR:**

The Kenan Institute en Washington  
The Frank Hawkins Kenan Institute of Private Enterprise  
Kenan-Flagler Business School  
University of North Carolina en Chapel Hill  
1300 Pennsylvania Avenue, NW  
North Tower, Suite 370  
Washington, DC 20004, USA  
Teléfono: (202) 289-6282  
Facsímil: (202) 331-4119

Agosto de 1999

# **ENVIRONMENTAL TECHNOLOGIES FOR THE NONFERROUS METALS MINING INDUSTRY**

A SOURCEBOOK OF U.S. SUPPLIERS OF POLLUTION PREVENTION AND CONTROL  
TECHNOLOGIES FOR THE MINING INDUSTRY

**A companion technology guide to  
*Best Management Practices in Nonferrous Metals Mining and Processing***

## **PREPARED FOR USAID BY:**

The Kenan Institute in Washington  
The Frank Hawkins Kenan Institute of Private Enterprise  
Kenan-Flagler Business School  
University of North Carolina at Chapel Hill  
1300 Pennsylvania Avenue, NW  
North Tower, Suite 370  
Washington, DC 20004, USA  
Tel: (202) 289-6282  
Fax: (202) 331-4119

August 1999

## **Reconocimientos**

Este libro de referencia fue auspiciado por el United States Agency for International Development (USAID) (Agencia de los Estados Unidos para el Desarrollo Internacional) y el Environmental Export Council (EEC), a través de La Iniciativa para Latino América para Tecnologías Ambientales.

The Kenan Institute Washington agradece al Dr. Gilbert Jackson, al Sr. Robert MacLeod, y a la Dra. Regina Ostergaard-Klem de USAID por sus valiosos comentarios y apoyo, a la Srta. Karen Kaplan de EEC por su ayuda global, al Sr. Jack Mazingo de Science Application International por el material de fondo, la Srta. Pamela Stella y el Sr. Mark Hardin de Golder Associates, Inc. por su revisión final de este libro de referencia, y la Srta. Rita Feinberg y el Sr. Rafael Ramirez Tuesta por su apoyo en la preparación del libro de referencia.

Para mayor información, por favor ponerse en contacto con:

Barbara McMurray, Directora – Programas Latinoamericanos  
Margaret Griffin, Asociada – Programas Latinoamericanos  
1300 Pennsylvania Avenue, NW  
North Tower, Suite 370  
Washington, DC 20004  
Teléfono: (202) 289-6282  
Facsímil: (202) 331-4119  
Dirección Electrónica: [kiwashington@kenan.org](mailto:kiwashington@kenan.org)

## **Acknowledgements**

This sourcebook was sponsored by the United States Agency for International Development (USAID) and the Environmental Export Council (EEC), through the Latin American Initiative for Environmental Technologies.

The Kenan Institute Washington thanks Dr. Gilbert Jackson, Mr. Robert MacLeod, and Dr. Regina Ostergaard-Klem of USAID for their valuable comments and support, Ms. Karen Kaplan of EEC for her overall assistance, Mr. Jack Mozingo of Science Application International for background material, Ms. Pamela Stella and Mr. Mark Hardin of Golder Associates, Inc. for their final review of this sourcebook, and Ms. Rita Feinberg and Mr. Rafael Ramirez Tuesta for their assistance in sourcebook preparation.

For more information, please contact:

Barbara McMurray, Director – Latin American Programs  
Margaret Griffin, Associate – Latin American Programs  
1300 Pennsylvania Avenue, NW  
North Tower, Suite 370  
Washington, DC 20004  
Tel: (202) 289-6282  
Fax: (202) 331-4119  
E-mail: [kiwashington@kenan.org](mailto:kiwashington@kenan.org)

## CONTENIDO

Introducción .....	1
I. Tratamiento de Aguas Residuales (Drenaje de Minas Acidas – AMD).....	5
II. Manejo de Agua y Aguas Residuales.....	13
III. Control de la Erosion y la Sedimentación.....	19
IV. Estabilización Fisica .....	23
V. Control de Contaminación del Aire.....	24
A. Control de Descarga de Monteras .....	27
B. Control de Escapes de Polvo .....	30
VI. Remediación.....	32
A. Suelos .....	33
B. Cultivo de la Tierra.....	34
VII. Manejo/Control de Materiales Peligrosos y Desperdicios.....	35
VIII. Monitoreo de Aire, Agua Residual y Corriente Efluente .....	38
IX. Manejo de Relaves.....	40
X. Cierre .....	44
XI. Reclamación/Revegetación.....	45
XII. Consultoría .....	48
Índice por Nombre de Compañías e Información de Contactos .....	57
Referencias .....	75

## TABLE OF CONTENTS

Introduction.....	1
I. Wastewater Treatment (Acid Mine Drainage).....	5
II. Water and Wastewater Management.....	13
III. Erosion and Sedimentation Control .....	19
IV. Physical Stabilization .....	23
V. Air Pollution Controls .....	24
A. Stack Discharge Controls.....	27
B. Fugitive Dust Controls.....	31
VI. Remediation .....	32
A. Soils .....	33
B. Land Farming .....	34
VII. Hazardous Materials and Waste Management/Controls .....	35
VIII. Monitoring Air, Wastewater and Effluents .....	38
IX. Tailings Management .....	40
X. Closure.....	44
XI. Reclamation/Revegetation.....	45
XII. Consulting .....	48
Index of Company Names and Contact Information.....	57
References .....	79

---

## Introducción

---

En Latinoamérica y a través del mundo, los minerales continúan siendo cruciales para las economías de varios países. Directa e indirectamente, la actividad minera sostiene miles de trabajos y contribuye significativamente a las exportaciones anuales. Inmersos en terrenos de cada tipo que se pueda concebir, los minerales presentan retos de competencia – cómo ser hallados, extraídos y refinados, y cómo evitar grandes peligros ambientales durante el proceso.

Latinoamérica ha visto un “boom” en el sector de la minería durante los años recientes. Desde 1994, la región ha sido el líder mundial de inversión en minerales. La inversión para hacer actividades de exploración en Latinoamérica creció 130 por ciento en los últimos cinco años. La minería representa una parte dominante de las economías de muchos países en Latinoamérica y el Caribe. Por ejemplo, 57% de la renta que Chile ganó por exportación en 1990 fue por la minería. También, \$2.2 billones de maquinaria minera fue exportado de los Estados Unidos a Latino América en 1996.

Conforme se establecen patrones ambientales y se ajustan las regulaciones existentes, las compañías mineras se ven obligadas a contemplar las implicaciones ambientales del manejo y operación de sus instalaciones. Una atención más cercana debe prestarse a los aspectos ambientales a lo largo de la vida de una mina desde el planeamiento hasta el cierre del lugar. Por lo tanto, es crucial que las compañías consideren los factores ambientales cuando seleccionan nuevos equipos o actualizan las instalaciones mineras y

---

## Introduction

---

In Latin America and throughout the world, minerals continue to be crucial to the economies of many countries. Directly and indirectly, the mining industry supports thousands of jobs and contributes significantly to annual exports. Imbedded in terrain of every conceivable type, minerals present competing challenges – how to find, extract and refine them, and how to protect against major environmental threats in the process.

There has been a boom in the mining sector in recent years. Since 1994 Latin America has been the world leader in terms of mineral investment. Exploration investment in the region has increased 130 percent in the last five years. Mining represents a dominant share of the economies of many LAC countries with Chile deriving 57% of its export revenue from the sector in 1990. In addition \$2.2 Billion worth of mining machinery was exported from the US in 1996 to the region.

As new environmental standards are being established and existing regulations tightened, mining companies are compelled to consider the environmental implications of the management and operation of their facilities. Closer attention must be paid to environmental aspects throughout the life of a mine, from planning to closure of the site. It is therefore crucial that companies consider environmental factors when selecting new equipment or upgrading existing mining and processing facilities.

Pollution is of particular concern in the mining industry. Acid drainage, soil erosion, air emissions, and chemical

procesadoras existentes.

La Contaminación es una preocupación especial en la industria minera. El drenaje de ácidos, erosión del suelo, emisión de gases, y desperdicios químicos, entre otros, imponen serios problemas de contaminación ambientales y usualmente requieren soluciones complejas y innovadoras. Conforme los gobiernos van ajustando los patrones ambientales y demandan mayor cumplimiento, las empresas mineras deben buscar métodos efectivos, en términos de costo, para afrontar el tema de la contaminación mientras que al mismo tiempo incrementan la calidad, la productividad y las utilidades. Dos enfoques alternativos están disponibles:

- Tratamiento “End-of pipe”: incorporación de equipo y empleo de procesos para recolectar o neutralizar desperdicios luego de haber sido generados (enfoque correctivo); o
- Producción más Limpia (o Prevención de La Contaminación): Un enfoque comprensivo para prevenir los impactos negativos al medio ambiente de un proceso de producción. Intenta reducir o eliminar la creación de contaminantes por buenas prácticas de limpieza en las plantas de producción, por procesos más eficaces, por la conservación de recursos, por el reciclaje y la reutilización, y por tecnología más limpia.

La segunda estrategia, prevención de la contaminación, ofrece importantes ventajas ambientales y empresariales. Mediante el empleo de prácticas ambientalmente probadas y el uso de procesos que incorporan tecnologías de prevención de la contaminación, las operaciones mineras pueden reducir

wastes, among others pose serious environmental pollution problems and often require complex and innovative solutions. As governments tighten environmental standards and demand stricter compliance, mining enterprises must seek cost-effective methods to address pollution issues while at the same time increase quality, productivity and profits. Two alternative approaches are available:

- “End-of pipe” treatment: addition of equipment and employment of processes to collect or neutralize wastes after they have been generated (corrective approach); or
- Cleaner Production (or Pollution Prevention): a comprehensive approach to preventing the negative environmental impacts of a production process. It seeks to reduce or eliminate the creation of pollutants through good housekeeping, increased process efficiency, resource conservation, recycling and reuse, and cleaner technology.

The second strategy, pollution prevention, offers important environmental and business advantages. By employing proven environmental practices and using processes that incorporate pollution prevention technologies, mining operations can significantly reduce the amount of pollution created – reducing “end-of-pipe” treatment. At the same time, additional cost savings can be realized from reduced water usage, lower use of expensive chemicals, and improved processing efficiencies.

U.S. companies are world leaders in advanced environmental technologies and pollution prevention. Over the past 25

significativamente el volumen de la contaminación creada – reducción del tratamiento “**end-of-pipe**”. Al mismo tiempo, ahorros adicionales pueden producirse al reducir el uso del agua, reducir el uso de químicos costosos y mejoras en la eficiencia de procesos.

Las compañías Estadounidenses son líderes mundiales en tecnologías ambientales avanzadas y de prevención de contaminación. A lo largo de los últimos 25 años –guiados por estrictas leyes y regulaciones ambientales- las compañías Norteamericanas han desarrollado tecnologías eficientes en terminos de costo, y de prevención y control de contaminación para cada faceta de la industria minera.

Este libro de referencia identifica proveedores norteamericanos de equipos, materiales, productos y servicios que ofrecen “tecnologías limpias” para la industria minera y, así complementa las *Prácticas Optimas de Manejo en la Explotación Minera y el Proceso de Metales No Ferrosos* del Proyecto de La Prevención de La Contamination Medioambiental (PPCM), auspiciado por la Agencia para el Desarrollo International de los EE.UU., el cual proporciona una descripción más amplia de la industria minera.

El propósito de este libro de referencia es promover la adopción de nuevas y mejores prácticas de gerencia ambiental y facilitar la inversión en tecnologías y procesos más limpios a través del uso de tecnología práctica, generalmente económica y avanzada. El estudio reconoce que soluciones económicas pueden dejar de resolver todos los problemas ambientales de una mina.

El libro de consulta está organizado en

years – driven by strict environmental laws and regulations – U.S. companies have developed cost-effective, pollution prevention and control technologies for every facet of the mining industry.

This sourcebook identifies U.S. suppliers of equipment, materials, products and services that offer “clean technologies” for the mining industry and thus complements the USAID sponsored, Environmental Pollution Prevention Project’s (EPPP) *Best Management Practices in Nonferrous Metals Mining and Processing*, which provides a broader description of the mining industry.

The purpose of this sourcebook is to promote the adoption of new and improved environmental management practices and to facilitate investment in cleaner processes through the use of practical, generally inexpensive, and advanced technology. The study acknowledges that inexpensive solutions may not always solve all environmental problems at a mine.

The sourcebook is organized around technologies that address the main environmental pollution sources in the mining industry, focusing on mining operations rather than ore processing and refining, because the field study conducted identified mining as the phase requiring the most urgent attention.

This publication has been prepared with the small and midsize mining operation in mind. While the authors understand that compliance to environmental standards is required for all mines regardless of their size, where possible, this resource is intentionally focused on practical solutions to pollution prevention and control over those that require intensive, large scale

torno a tecnologías que abordan las fuentes de contaminación más importantes en la industria minera, centrándose en operaciones extractivas en lugar de procesamiento y refinamiento de minerales, debido a que el trabajo de campo identificó a la etapa extractiva como la fase que requiere la atención más urgente.

Esta publicación ha sido preparada teniendo en consideración operaciones mineras pequeñas y medianas. Los autores entienden que el cumplimiento de patrones ambientales es exigido a todas las minas, independientemente de su tamaño, donde es posible, este recurso se centra intencionalmente en soluciones prácticas para la prevención y control de la contaminación, sobre aquellas que requieren inversiones intensivas en capital y de gran escala.

Cada sección contiene una breve descripción de las tecnologías aplicables e incluye los nombres y contactos de empresas norteamericanas que pueden abastecer los productos y servicios. Para la conveniencia del lector, cuando una compañía aparece en más de un encabezado, toda la información de la compañía es presentada bajo cada encabezado correspondiente. El índice al final del directorio proporciona una lista alfabética de las compañías.

La descripción de las compañías y sus productos están basadas en la información proporcionada por cada compañía. Las compañías también seleccionaron las categorías bajo las cuáles prefirieron ser listadas.

capital investments.

Each section contains a brief description of the applicable technologies and includes the names and contact information for U.S. companies that can supply the products or services. For the convenience of the reader, when a company appears in more than one heading, all company information is presented under each corresponding heading. The index at the end of the sourcebook provides an alphabetical listing of the companies.

Company and product descriptions are based on information provided by each company. The companies also selected the categories under which they preferred to be listed.

The Kenan Institute has not independently verified the performance, characteristics or other features described by manufacturers and therefore does not assume any responsibility for the claims made by the firms listed here.

*El Kenan Institute no ha verificado de manera independiente las características del desempeño y otros rasgos descritos por los fabricantes y por lo tanto no asume ninguna responsabilidad por las afirmaciones realizadas por las compañías aquí listadas.*

---

**I. Tratamiento de Aguas Residuales (Drenaje de Minas Ácidas – AMD)**

---

El más grande contribuyente de drenaje de minas ácidas es de lejos la operación minera en sí, debido a los enormes volúmenes de desperdicio sulfúrico producido en algunas minas. El procesamiento de material que contiene mineral produce no sólo metales útiles y valiosos sino materiales de desecho – relaves, roca de desecho y frecuentemente líquidos efluentes. Con el tiempo la exposición de rocas y relaves que contienen sulfuro al oxígeno y agua, pueden generar líquidos en los cuales los metales pesados son disueltos o suspendidos, dando como resultado el AMD. Bajo estas condiciones y con la presencia de bacterias, se genera ácido sulfúrico. El proceso libera **hierro férrico**, que nuevamente actúa como un agente oxidante para oxidar aún más el sulfuro.

Los aspectos técnicos de las soluciones al problema del AMD puede ser separado en distintas áreas técnicas. El objetivo es desarrollar técnicas eficientes en términos de costos para controlar la generación de AMD y ser capaz de predecir los efectos de estas tecnologías en el largo plazo. Si se puede prevenir que el oxígeno, el agua o ambos reaccionen con el material de sulfuro, la producción de AMD puede ser detenida. Barreras húmedas o secas pueden lograr esto. Aún cuando los principios básicos para el control y la prevención del AMD son comunes a todas las minas, las diferencias en ubicación, topografía, características del subsuelo, cantidad de agua en el área, clima y rudeza de los materiales de desperdicio, requieren soluciones específicas. Por ejemplo, relaves chancados finamente imponen un

---

**I. Wastewater Treatment (Acid Mine Drainage - AMD)**

---

The largest contributor to acid mine drainage (AMD) by far is the mining operation itself, because of the enormous volume of sulfide wastes produced at some mines. The processing of mineral bearing ore produces not only the useful and valuable metals but also waste materials – tailings, waste rock and frequently liquid effluents-. Over time the exposure of sulfide bearing waste rock and tailings to oxygen and water can generate liquid in which heavy metals are dissolved or suspended, resulting in AMD. Under these conditions and in the presence of bacteria, sulfuric acid is generated. The process releases ferric iron, which again acts as an oxidizing agent to oxidize yet more sulfites.

The technical aspects of solutions to the problem of AMD can be separated into distinct technical areas. The objective is to develop cost-effective technologies to control AMD generation and to be able to predict the effects of these technologies over the long term. If oxygen, water or both can be prevented from reacting with the sulfide material, the production of AMD can be stopped. Dry and wet barriers can achieve this. Even though the basic principles of controlling and preventing AMD are common to all mines, the differences in location, topography, sub-surface characteristics, amount of water in the area, climate and the coarseness of the waste materials all require specific solutions. For example, finely crushed tailings pose a different set of problems than wastes made up of large pieces of rock. Exposed wall surfaces pose yet another problem. These variables

1 ? Tratamiento de Aguas Residuales (AMD)  
? Wastewater Treatment

conjunto distinto de problemas que desperdicios compuestos de grandes piezas de roca. Estas variables combinadas con los resultados de pruebas en laboratorio, forman la base para la predicción del grado de AMD. Toda la idea detrás de la predicción es usar la información que uno puede juntar para que ayuden a predecir la probabilidad de AMD.

Algunas de las aplicaciones incluyen pantanos naturales o artificiales, a pesar que la efectividad es limitada en algunas ocasiones debido a la extensión y severidad del invierno y la rapidez de la primavera; desagües de piedra caliza; canales abiertos de piedra caliza; pozos de diversificación; entre otros.

El tratamiento para el drenaje ácido de minas incluye los siguientes métodos:

- **Recolección:** el drenaje ácido es recolectado y combinado con mezclas de cal u otro catalizador, lo que incrementa la alcalinidad. Bajo estas condiciones, los metales pesados y contaminantes disueltos en el agua ácida son removidos, con lodo como un subproducto. Luego el lodo debe ser curado.
- **Cubiertas Secas:** cubiertas de tierra de baja permeabilidad y cubiertas vegetativas representan una capa cobertora situada sobre los desperdicios mineros que puede prevenir el rápido ingreso del oxígeno hacia el desperdicio. Estas cubiertas detienen o reducen la producción de ácido.
- **Cubiertas Consumidoras de Oxígeno:** varios materiales, incluyendo desperdicios de otras industrias y ciudades, proveen un excelente potencial a bajo costo para generar

combined with results of laboratory testing form the basis for prediction of AMD degree. The whole idea behind prediction is to use the information one can gather to help predict the probability of AMD.

Some of the applications include natural and engineered wetlands, although the effectiveness of this approach is limited in some locations due to length and severity of winter and rapid spring run off; anoxic limestone drains; open limestone channels; and diversion wells, among others.

Treatment for acid mine drainage includes the following methods:

- **Collection:** acid drainage is collected and combined with lime slurry or other catalysts, which increases the alkalinity. Under these conditions, the heavy metals and contaminants dissolved in the acid water are removed, with sludge as a by-product. Then the sludge must be healed.
- **Dry Covers:** low permeability soil and vegetative cover represent a cover layer sitting on top of the mine waste that can prevent the rapid ingress of water and oxygen into the waste. These covers stop or slow down the production of acid.
- **Oxygen Consuming Covers:** several materials, including waste materials from other industries and cities, provide excellent potential at lower cost for generating oxygen-reducing cover on mine tailings, for short term purposes.
- **Wet Covers and Underwater Disposal:** water prevents the oxidation of sulfide waste by creating an oxygen barrier between the mine waste and the open air. This method is being confirmed as the best prevention technology for unoxidized sulphide-containing wastes,

cubiertas que reducen el oxígeno en los relaves mineros, para propósitos de corto plazo.

- Cubiertas Húmedas y Eliminación Submarina: el agua evita la oxidación de desperdicio sulfúrico mediante la creación de una barrera de oxígeno entre el desperdicio minero y el aire abierto. Este método está siendo confirmado como la mejor tecnología de prevención para desperdicios que contienen sulfuro sin oxidar, siempre que los relaves puedan permanecer sumergidos a través de todas las estaciones.
- Minería selectiva de yacimientos con el menor potencial de problemas de residuo ácido.
- Ubicación de minerales con potencial para la generación de ácido en minas de tajo abierto o como relleno en minas subterráneas.
- La medida preventiva ideal es reducir o remover los componentes sulfúricos antes que los relaves sean descargados.

provided the tailings can remain submerged through all seasons.

- Selective Mining of ore bodies with the least potential for acid run off problems.
- Placement of potential acid generating materials in open pits or as backfill in underground mines.
- The ideal preventative measure is to reduce or remove the sulfide components before discharging the tailings.

**Advanced Drainage Systems, Inc**

3300 Riverside Drive

Columbus, Ohio 43221 - USA

**Tel:** 614-457-3051

**Fax:** 614-538-5825

**Web Page:** [www.ads-pipe.com](http://www.ads-pipe.com)

**Contact:** John Adams

**E-mail:** [jadams@infinet.com](mailto:jadams@infinet.com)

**Products:** Polyethylene Drainage Pipe, Fittings, Couplings, Geotextiles, Geogrids, Silt Fence, Erosion Control Mats, Filter Fabric Wraps.

**Company Statement of Capabilities:** Incorporated in 1966, Advanced Drainage Systems, Inc. is the world's largest manufacturer of high-density polyethylene drainage pipe.

Producing pipe in 3" (80mm) to 60" (1500mm) diameters, plus a complete line of fittings and couplings, ADS offers a total system for effective and cost-efficient drainage. Specific products include standard corrugated pipe, smooth interior storm sewer pipe, a superior panel-shaped drainage pipe, catch basins and geotextiles. With the Company's rapid growth has come a corresponding organizational commitment to customers and material specifiers.

I ? Tratamiento de Aguas Residuales (AMD)  
? Wastewater Treatment

***(Advanced Drainage Systems, Inc., cont'd)***

ADS operates 20 regional manufacturing plants and maintains product inventory and sales assistance at 33 Distribution centers across the U.S. The Company also delivers products through its relationship with over 4,000 independent distributors. A staff of 18 regional engineers, complimenting a field of over 150 sales professionals, provides local technical installation assistance to government agencies, private consultants, and contractors. As the world continues the enormous task of rebuilding yesterday's infrastructure, ADS helps streamline the process with an engineered, totally plastic drainage system that offers superior hydraulic performance, lower installation and maintenance costs, and significantly longer service life.

**Amoco Fabrics & Fiber Company**

260 The Bluffs

Austell, Georgia 30168 - USA

**Tel:** 770-944-4569

**Fax:** 770-944-4584

**Web Page:** [www.geotextiles@amoco.com](http://www.geotextiles@amoco.com)

**Contact:** Jose Roberto Montalvo

**E-mail:** [geotextiles@amoco.com](mailto:geotextiles@amoco.com)

**Products:** Woven and Nonwoven Geotextiles

**Company Statement of Capabilities:** Amoco Fabrics & Fibers Company is a part of the BPAmoco group. Amoco Fabrics & Fibers is a major producer of Woven and Nonwoven geotextiles as well as the largest producer of carpet backing. We have manufacturing facilities in the USA (Alabama, Georgia and South Carolina), Europe (Germany), Brasil (Curitiba), and Mexico (Matehuala). Amoco Woven and Nonwoven geotextiles are used in many applications such as: New and Old Roadway Construction, Drainage Applications, Erosion Control, Retaining Walls, Municipal and Hazardous Waste Facilities, Mining, Dams, Tunnels, and Others Civil Engineering Applications.

**Applied Surface Technologies AST Coatings Applied**

1423 West Ormsby Avenue

Louisville, Kentucky 40210 - USA

**Tel:** 502-634-9458

**Fax:** 502-634-1130

**Web Page:** [www.astl.com](http://www.astl.com)

**Contact:** Dave McEwan

**E-mail:** [tech@astl.com](mailto:tech@astl.com)

**Products:** Surface Coatings - ElectroFin, Bio Technology for cleaning.

**Company Statement of Capabilities:** AST applies high performance coatings to prevent corrosion of fin and tube heat exchangers. AST also sells cleaning systems for bacterial films (green slime) often present on heat exchangers or other surfaces.

**Baker Process, division of Baker Hughes Inc.**

669 West 200 South Street P.O. Box 300

Salt Lake City, Utah 84110 - USA

**Tel:** 801-526-2909

**Fax:** 801-526-2923

**Contact:** Frank Baczek

**E-mail:** Frank.Baczek@bakerhughes.com

**Products:** Clarifiers, Thickeners, Filters, Flotation Cells, Column Flotation Cells.

**Company Statement of Capabilities:** Baker Process offers a wide range of equipment for solid-liquid applications proven over decades of dependable service. This range of equipment originates both from internal research and development and from external licenses of major worldwide process equipment designers. Baker Process is a division of Baker Hughes Inc. and is organized to effectively and efficiently serve a truly worldwide industry from four geographic operating regions. Baker Process maintains a comprehensive range of technology, design, engineering and manufacturing capabilities. A single piece of equipment or a complete process plant designed, supplied, erected and commissioned on a turn-key basis can be provided.

**CertainTeed Products Group**

750 Swedesford Road, P.O. Box 860

Valley Forge, Pennsylvania 19482 - USA

**Tel:** 610-341-7000

**Fax:** 610-341-6837

**Contact:** Ken McHugh

**Products:** Pipe & Plastics: Plastic, Abrasion resistant

**Company Statement of Capabilities:** CertainTeed Corporation is a wholly owned subsidiary of Saint Gobain which is headquartered in Paris, France. Saint Gobain is a leading producer of flat glass, glass containers, reinforcements, building materials, abrasives, industrial ceramics and pipe. The company employs more than 100,000 people worldwide in over 580 consolidated companies. CertainTeed Corporation is headquartered in Valley Forge, PA. CertainTeed produces and exports worldwide specialty piping systems for the industrial mining, irrigation and water well markets from four strategically located extrusion plants. CertainTeed also maintains its own ISO 9002 PVC resin manufacturing plant in Sulfur, LA.

**Chester Engineers**

Cherrington Corporate Center, 600 Clubhouse Drive

Moon Township, Pennsylvania 15108 - USA

**Tel:** 800-337-0777, 412-269-5700

**Fax:** 412-269-5749

**Web Page:** www.chester-engineers.com

**Contact:** Robert Zick (Peru Team), Lori Bonham

**E-mail:** ZickR@usfilter.com

**Products:** Engineering: water, wastewater, air quality, geoscience and environmental management (i.e. assessment and remediation), environmental and information systems.

1 ? Tratamiento de Aguas Residuales (AMD)  
? Wastewater Treatment

***(Chester Engineers cont'd)***

***Company Statement of Capabilities:*** Chester Engineers, one of the nation's leading engineering firms in water, wastewater, air quality, geoscience and environmental management, has been providing both industries and municipalities with exceptional solutions for their water and wastewater problems since 1910. Our engineering services range from comprehensive turnkey solutions to targeted, client-specific services. The flexibility of our capabilities and our product diversity allow Chester the ability to provide clients with single-source solutions for any problem, small or large. Chester Engineers is part of United States Filter Corporation, the leading global provider of industrial, municipal and residential water and wastewater treatment systems, products and services.

**Coeur d'Alene Mines Corporation**

505 Front Avenue, P.O. Box 1  
Coeur D'Alene, Idaho 83816-0316 - USA

***Tel:*** 208-667-3511

***Fax:*** 208-667-2213

***Web Page:*** [www.coeur.com](http://www.coeur.com)

***Contact:*** Luke Russell

***E-mail:*** [lrussell@coeur.com](mailto:lrussell@coeur.com)

***Products:*** Cyanisorb™ technology recovers cyanide directly from gold mill tailings for recycle back to leaching circuit; removes cyanide prior to disposal of tailing, average recovery is 80-90 percent, with plant operating costs offset by the value of the recovered.

***Company Statement of Capabilities:*** Coeur d' Alene Mines Corp. is North America's leading low-cost primary silver producer and a significant gold producer with interests in Nevada, Idaho, Alaska, Chile, Australia and Bolivia. Recognized as a leader in environmental stewardship, Coeur has received 19 environmental awards for leadership and commitment to environmental protection over the last decade.

**Fluid Systems (FSI)**

1245 Corporate Blvd. Suite 300  
Aurora, Illinois 60504 - USA

***Tel:*** 800-346-9107, 630-898-1161

***Fax:*** 630-898-1179

***Web Page:*** [www.fluidsystems.com](http://www.fluidsystems.com)

***Contact:*** Linda Englander

***E-mail:*** [fsi@fluidsystems.com](mailto:fsi@fluidsystems.com)

***Products:*** Geotextiles, TEX-NET® Geocomposites, TEX-NET® Ultra high flow geocomposites, BENTOFIX® Thermal Lock geosynthetic clay liners, SANI-COVER® daily cover, GoeLok™ cellular confinement system, Strata Grid geogrids, HYDROTEX fabric formed concrete.

***Company Statement of Capabilities:*** Fluid Systems is a leading supplier of a wide range of geosynthetics for the waste containment industry, including POLY-NET® drainage nets, TEX-NET® and TEX-NET® ULTRA geocomposites, Bentofix® Thermal Lock GCLs, geotextiles, geogrids, SANI-COVER® daily covers, Hydrotex™ fabric formed concrete and Geolok™ Cellular Confinement System.

**Great Western Chemical Company**

808 S.W. 15th Avenue

Portland, Oregon 97205 - USA

**Tel:** 503-228-2600, 800-547-1400

**Fax:** 503-221-5752

**Web Page:** [www.gwchem.com](http://www.gwchem.com)

**Contact:** Taras Warvariv

**E-mail:** [taraswarvariv@gwchem.com](mailto:taraswarvariv@gwchem.com)

**Products:** Powder-emulsion and liquid flocculants, Coagulants-scale and corrosion inhibitors, Viscosity modifiers and equipment packages.

**Company Statement of Capabilities:** Great Western Chemical Company is a United States company with annual sales in excess of \$260MM. We are the 8th largest distributor in North America with an asset base of over \$50MM and have been in business for over 60 years. We have 36 offices/stocking locations throughout USA, Canada, Mexico, China, Russia and presently South America through local partnership-representation. We are a full line chemicals program provider. Our focus is on service, sales, logistical support and complete technical programs for our customers. Our highly trained force includes both mining and metallurgical-environmental engineers supported by our fully staffed technical center. We are well positioned to meet your expectations.

**Smith Fiberglass Products Company**

2700 W. 65th Street

Little Rock, Arkansas 72209 - USA

**Tel:** 501-568-4010

**Fax:** 501-568-4465

**Web Page:** [www.smithfiberglass.com](http://www.smithfiberglass.com)

**Contact:** Susan B. Jones

**E-mail:** [sjones@aosmith.com](mailto:sjones@aosmith.com)

**Products:** Pipe plastic, fiberglass or epoxy, abrasion resistant, pipe fittings, corrosion resistant, secondary containment piping.

**Company Statement of Capabilities:** Smith Fiber Glass Products supplies millions of feet of pipe to various industries worldwide, including oil and gas companies, pulp and paper mills, industrial plants, the mining industry, chlorine-caustic plants, power plants, steel mills, the chemical process industry, gasoline service stations, food processing plants, refineries, air conditioning, and water and wastewater plants. Nine standard piping systems are available in size from 1-inch through 48-inch diameters and temperatures to 250 F. Smith Fiber Glass offers a choice of joining methods such as bell and spigot or socket joints. The company also manufactures a complete line of fittings and accessories such as tapering tools.

**The Gorman-Rupp Company**

305 Bowman Street, P.O. Box 1217

Mansfield, Ohio 44901-1217 - USA

**Tel:** 419-755-1011, 419-755-1350, 419-755-1352

**Fax:** 419-755-1266

**Web Page:** [www.gormanrupp.com](http://www.gormanrupp.com)

I ? Tratamiento de Aguas Residuales (AMD)  
? Wastewater Treatment

***(The Gorman-Rupp Company cont'd)***

**Contact:** Taffy DeNavia

**E-mail:** tdenavia@gormanrupp.com

**Products:** Pumps & Packaged Pumping Systems with Controls

**Company Statement of Capabilities:** The Gorman-Rupp Company is a leading manufacturer of self priming, submersible and rotary gear pumps and complete fluid handling systems with a 66 year reputation for innovative technology, excellent production quality and a well trained distribution network serving the needs of global end users. Gorman-Rupp pumps are key elements of fluid systems in the water/wastewater, construction, mining, industrial, agricultural and petroleum market segments. In Latin America Gorman-Rupp has developed an understanding of the needs of the mining sector and has been pleased to service the equipment requirements of mining end users in nearly all countries. In addition to the traditional gold, silver, copper and coal Gorman-Rupp has also been quite active in non-ferrous mining such as nitrates and industrial salts.

**Tramfloc, Inc.**

P.O. Box 350

Tempe, Arizona 85280-0350 - USA

**Tel:** 800-613-6803, 480-491-6895

**Fax:** 480-456-1664

**Web Page:** www.tramfloc.com

**Contact:** James Franklin

**E-mail:** water@tramfloc.com

**Products:** Equipment & Chemicals: Flocculants, polymers, mining chemicals, chlorinators, all organic wetting and release agents.

**Company Statement of Capabilities:** Tramfloc Inc. provides water treatment equipment and chemicals for water and wastewater plants. The company sells and services systems for sludge dewatering such as belt filter presses and thickeners, ion exchange for contaminant removal, reverse osmosis, chemical feeding and control, filter gravel and anthracite, tablet chlorination and dechlorination chemicals and systems, filters for potable, pool, waste and process water. The firm handles instrumentation, such as scales, monitors, detectors and alarms. Tramfloc carries flocculants for mining tailings, thickeners and concentrates for precious and base metal mines. The company has an international division which serves its off-shore customers from the Phoenix headquarters.

**Warman International, Inc.**

2701 South Stoughton Road, P.O. Box 7610

Madison, Wisconsin 53707-7610 - USA

**Tel:** 608-221-2261

**Fax:** 609-221-5810

**Web Page:** www.warmanintl.com

**Contact:** Julie Capadona

**E-mail:** generalinfo@warmanintl.com

**Products:** Pumps: Centrifugal and Turbine, Corrosive Liquids, Dredge and Gravel, Sand and Slime, Sump, Blasthole Dewatering.

**Warman International Chile SA**

Avda. Américo Vespucio # 2512

Conchalí, Santiago, Chile

**Tel:** 2-624-1820

**Fax:** 2-624-1812

**Web Page:** www.warmanintl.com

**E-mail:** generalinfo@warmanintl.com

**Products:** Pumps: Centrifugal and Turbine, Corrosive Liquids, Dredge and Gravel, Sand and Slime, Sump, Blasthole Dewatering.

---

**II. Manejo de Agua y Aguas Residuales**

El agua está involucrada en casi todos los aspectos de la actividad minera. Encontrar técnicas óptimas para tratar el agua residual y regresarla al medio ambiente es uno de los temas más importantes que una operación minera maneja rutinariamente. El agua residual puede contener los siguientes elementos contaminantes: dióxido de sulfuro, plomo, mercurio, metales pesados, soluciones de pH alto o bajo, y otros desperdicios líquidos o sólidos. La falta de un sistema adecuado para tratar el agua residual puede resultar en un impacto importante en el medio ambiente.

Reducir la cantidad de agua en contacto con elementos contaminantes es un enfoque básico empleado para reducir el uso de costosos métodos para tratar agua contaminada. Además, dado el intenso uso del agua, se pueden lograr una reducción de costos incrementando la cantidad de agua que es reusada. Las siguientes compañías proveen tecnología que pueden ayudar a las operaciones mineras a encontrar soluciones apropiadas para el manejo del agua y del agua residual.

---

**II. Water and Wastewater Management**

Water is involved in almost every aspect of mining activities. Finding optimum techniques to treat wastewater and return it to the environment is one of the main issues that mine operations deal with routinely. Wastewater may include the following polluting agents: sulfur dioxide, lead, mercury, heavy metals, low or high pH solutions, and other liquid or solid wastes. The lack of an adequate system to treat wastewater may result in an important impact on the environment.

Reducing the amount of water in contact with pollutant elements is a basic approach taken to reduce the use of expensive methods to treat contaminated water. In addition, given the intense use of water, cost reductions can be achieved by increasing the amount of water that is reused. The following companies provide technology that can help mine operations to find appropriate solutions to manage water and wastewater.

**Advanced Drainage Systems, Inc**

3300 Riverside Drive  
Columbus, Ohio 43221 - USA

**Tel:** 614-457-3051

**Fax:** 614-538-5825

**Web Page:** www.ads-pipe.com

**Contact:** John Adams

**E-mail:** jadams@infinet.com

**Products:** Polyethylene Drainage Pipe, Fittings, Couplings, Geotextiles, Geogrids, Silt Fence, Erosion Control Mats, Filter Fabric Wraps.

**Company Statement of Capabilities:** Incorporated in 1966, Advanced Drainage Systems, Inc. is the world's largest manufacturer of high-density polyethylene drainage pipe. Producing pipe in 3" (80mm) to 60" (1500mm) diameters, plus a complete line of fittings and couplings, ADS offers a total system for effective and cost-efficient drainage. Specific products include standard corrugated pipe, smooth interior storm sewer pipe, a superior panel-shaped drainage pipe, catch basins and geotextiles. With the Company's rapid growth has come a corresponding organizational commitment to customers and material specifiers. ADS operates 20 regional manufacturing plants and maintains product inventory and sales assistance at 33 Distribution centers across the U.S. The Company also delivers products through its relationship with over 4,000 independent distributors. A staff of 18 regional engineers, complimenting a field of over 150 sales professionals, provides local technical installation assistance to government agencies, private consultants, and contractors. As the world continues the enormous task of rebuilding yesterday's infrastructure, ADS helps streamline the process with an engineered, totally plastic drainage system that offers superior hydraulic performance, lower installation and maintenance costs, and significantly longer service life.

**Amoco Fabrics & Fiber Company**

260 The Bluffs  
Austell, Georgia 30168 - USA

**Tel:** 770-944-4569

**Fax:** 770-944-4584

**Web Page:** www.geotextiles@amoco.com

**Contact:** Jose Roberto Montalvo

**E-mail:** geotextiles@amoco.com

**Products:** Woven and Nonwoven Geotextiles

**Company Statement of Capabilities:** Amoco Fabrics & Fibers Company is a part of the BPA Amoco group. Amoco Fabrics & Fibers is a major producer of Woven and Nonwoven geotextiles as well as the largest producer of carpet backing. We have manufacturing facilities in the USA (Alabama, Georgia and South Carolina), Europe (Germany), Brasil (Curitiba), and Mexico (Matehuala). Amoco Woven and Nonwoven geotextiles are used in many applications such as: New and Old Roadway Construction, Drainage Applications, Erosion Control, Retaining Walls, Municipal and Hazardous Waste Facilities, Mining, Dams, Tunnels, and Others Civil Engineering Applications.

**Applied Surface Technologies AST Coatings Applied**

1423 West Ormsby Avenue  
Louisville, Kentucky 40210 - USA

**Tel:** 502-634-9458

**Fax:** 502-634-1130

**Web Page:** www.astl.com

**Contact:** Dave McEwan

**E-mail:** tech@astl.com

**Products:** Surface Coatings - ElectroFin, Bio Technology for cleaning.

**Company Statement of Capabilities:** AST applies high performance coatings to prevent corrosion of fin and tube heat exchangers. AST also sells cleaning systems for bacterial films (green slime) often present on heat exchangers or other surfaces.

**Baker Process, division of Baker Hughes Inc.**

669 West 200 South Street P.O. Box 300  
Salt Lake City, Utah 84110 - USA

**Tel:** 801-526-2909

**Fax:** 801-526-2923

**Contact:** Frank Baczek

**E-mail:** Frank.Baczek@bakerhughes.com

**Products:** Clarifiers, Thickeners, Filters, Flotation Cells, Column Flotation Cells.

**(Baker Process, division of Baker Hughes Inc. cont'd)**

**Company Statement of Capabilities:** Baker Process offers a wide range of equipment for solid-liquid applications proven over decades of dependable service. This range of equipment originates both from internal research and development and from external licenses of major worldwide process equipment designers. Baker Process is a division of Baker Hughes Inc. and is organized to effectively and efficiently serve a truly worldwide industry from four geographic operating regions. Baker Process maintains a comprehensive range of technology, design, engineering and manufacturing capabilities. A single piece of equipment or a complete process plant designed, supplied, erected and commissioned on a turn-key basis can be provided.

**CertainTeed Products Group**

750 Swedesford Road, P.O. Box 860  
Valley Forge, Pennsylvania 19482 - USA

**Tel:** 610-341-7000

**Fax:** 610-341-6837

**Contact:** Ken McHugh

**Products:** Pipe & Plastics: Plastic, Abrasion resistant

**Company Statement of Capabilities:** CertainTeed Corporation is a wholly owned subsidiary of Saint Gobain which is headquartered in Paris, France. Saint Gobain is a leading producer of flat glass, glass containers, reinforcements, building, materials, abrasives, industrial ceramics and pipe. The company employs more than 100,000 people worldwide in over 580 consolidated companies. CertainTeed Corporation is headquartered in Valley Forge, PA. CertainTeed produces and exports worldwide

II ? Manejo de Agua y Aguas Residuales  
? Water and Wastewater Management

***(CertainTeed Products Group cont'd)***

specialty piping systems for the industrial mining, irrigation and water well markets from four strategically located extrusion plants. CertainTeed also maintains its own ISO 9002 PVC resin manufacturing plant in Sulfur, LA.

**Chester Engineers**

Cherrington Corporate Center, 600 Clubhouse Drive  
Moon Township, Pennsylvania 15108 - USA

**Tel:** 800-337-0777, 412-269-5700

**Fax:** 412-269-5749

**Web Page:** www.chester-engineers.com

**Contact:** Robert Zick (Peru Team), Lori Bonham

**E-mail:** ZickR@usfilter.com

**Products:** Engineering: water, wastewater, air quality, geoscience and environmental management (i.e. assessment and remediation), environmental and information systems.

**Company Statement of Capabilities:** Chester Engineers, one of the nation's leading engineering firms in water, wastewater, air quality, geoscience and environmental management, has been providing both industries and municipalities with exceptional solutions for their water and wastewater problems since 1910. Our engineering services range from comprehensive turnkey solutions to targeted, client-specific services. The flexibility of our capabilities and our product diversity allow Chester the ability to provide clients with single-source solutions for any problem, small or large. Chester Engineers is part of United States Filter Corporation, the leading global provider of industrial, municipal and residential water and wastewater treatment systems, products and services.

**Coeur d'Alene Mines Corporation**

505 Front Avenue, P.O. Box 1  
Coeur D'Alene, Idaho 83816-0316 - USA

**Tel:** 208-667-3511

**Fax:** 208-667-2213

**Web Page:** www.coeur.com

**Contact:** Luke Russell

**E-mail:** lrussell@coeur.com

**Products:** Cyanisorb™ technology recovers cyanide directly from gold mill tailings for recycle back to leaching circuit; removes cyanide prior to disposal of tailing, average recovery is 80-90 percent, with plant operating costs offset by the value of the recovered.

**Company Statement of Capabilities:** Coeur d'Alene Mines Corp. is North America's leading low-cost primary silver producer and a significant gold producer with interests in Nevada, Idaho, Alaska, Chile, Australia and Bolivia. Recognized as a leader in environmental stewardship, Coeur has received 19 environmental awards for leadership and commitment to environmental protection over the last decade.

**Fluid Systems (FSI)**

1245 Corporate Blvd. Suite 300

Aurora, Illinois 60504 - USA

**Tel:** 800-346-9107, 630-898-1161

**Fax:** 630-898-1179

**Web Page:** [www.fluidsystems.com](http://www.fluidsystems.com)

**Contact:** Linda Englander

**E-mail:** [fsi@fluidsystems.com](mailto:fsi@fluidsystems.com)

**Products:** Geotextiles, TEX-NET® Geocomposites, TEX-NET® Ultra high flow geocomposites, BENTOFIX® Thermal Lock geosynthetic clay liners, SANI-COVER® daily cover, GoeLok™ cellular confinement system, Strata Grid geogrids, HYDROTEX fabric formed concrete.

**Company Statement of Capabilities:** Fluid Systems is a leading supplier of a wide range of geosynthetics for the waste containment industry, including POLY-NET® drainage nets, TEX-NET® and TEX-NET® ULTRA geocomposites, Bentofix® Thermal Lock GCLs, geotextiles, geogrids, SANI-COVER® daily covers, Hydrotex™ fabric formed concrete and Geolok™ Cellular Confinement System.

**Great Western Chemical Company**

808 S.W. 15th Avenue

Portland, Oregon 97205 - USA

**Tel:** 503-228-2600, 800-547-1400

**Fax:** 503-221-5752

**Web Page:** [www.gwchem.com](http://www.gwchem.com)

**Contact:** Taras Warvariv

**E-mail:** [taraswarvariv@gwchem.com](mailto:taraswarvariv@gwchem.com)

**Products:** Powder-emulsion and liquid flocculants, Coagulants-scale and corrosion inhibitors, Viscosity modifiers and equipment packages.

**Company Statement of Capabilities:** Great Western Chemical Company is a United States company with annual sales in excess of \$260MM. We are the 8th largest distributor in North America with an asset base of over \$50MM and have been in business for over 60 years. We have 36 offices/stocking locations throughout USA, Canada, Mexico, China, Russia and presently South America through local partnership-representation. We are a full line chemicals program provider. Our focus is on service, sales, logistical support and complete technical programs for our customers. Our highly trained force includes both mining and metallurgical-environmental engineers supported by our fully staffed technical center. We are well positioned to meet your expectations.

**Smith Fiberglass Products Company**

2700 W. 65th Street

Little Rock, Arkansas 72209 - USA

**Tel:** 501-568-4010

**Fax:** 501-568-4465

**Web Page:** [www.smithfiberglass.com](http://www.smithfiberglass.com)

**Contact:** Susan B. Jones

**E-mail:** [sjones@aosmith.com](mailto:sjones@aosmith.com)

***(Smith Fiberglass Products Company cont'd)***

**Products:** Pipe plastic, fiberglass or epoxy, abrasion resistant, pipe fittings, corrosion resistant, secondary containment piping.

**Company Statement of Capabilities:** Smith Fiber Glass Products supplies millions of feet of pipe to various industries worldwide, including oil and gas companies, pulp and paper mills, industrial plants, the mining industry, chlorine-caustic plants, power plants, steel mills, the chemical process industry, gasoline service stations, food processing plants, refineries, air conditioning, and water and wastewater plants. Nine standard piping systems are available in size from 1-inch through 48-inch diameters and temperatures to 250 F. Smith Fiber Glass offers a choice of joining methods such as bell and spigot or socket joints. The company also manufactures a complete line of fittings and accessories such as tapering tools.

**The Gorman-Rupp Company**

305 Bowman Street, P.O. Box 1217  
Mansfield, Ohio 44901-1217 - USA

**Tel:** 419-755-1011, 419-755-1350, 419-755-1352

**Fax:** 419-755-1266

**Web Page:** [www.gormanrupp.com](http://www.gormanrupp.com)

**Contact:** Taffy DeNavia

**E-mail:** [tdenavia@gormanrupp.com](mailto:tdenavia@gormanrupp.com)

**Products:** Pumps & Packaged Pumping Systems with Controls

**Company Statement of Capabilities:** The Gorman-Rupp Company is a leading manufacturer of self priming, submersible and rotary gear pumps and complete fluid handling systems with a 66 year reputation for innovative technology, excellent production quality and a well trained distribution network serving the needs of global end users. Gorman-Rupp pumps are key elements of fluid systems in the water/wastewater, construction, mining, industrial, agricultural and petroleum market segments. In Latin America Gorman-Rupp has developed an understanding of the needs of the mining sector and has been pleased to service the equipment requirements of mining end users in nearly all countries. In addition to the traditional gold, silver, copper and coal Gorman-Rupp has also been quite active in non-ferrous mining such as nitrates and industrial salts.

**Tramfloc, Inc.**

P.O. Box 350

Tempe, Arizona 85280-0350 - USA

**Tel:** 800-613-6803, 480-491-6895

**Fax:** 480-456-1664

**Web Page:** [www.tramfloc.com](http://www.tramfloc.com)

**Contact:** James Franklin

**E-mail:** [water@tramfloc.com](mailto:water@tramfloc.com)

**Products:** Equipment & Chemicals: Flocculants, polymers, mining chemicals, chlorinators, all organic wetting and release agents.

**Company Statement of Capabilities:** Tramfloc Inc. provides water treatment equipment and chemicals for water and wastewater plants. The company sells and services systems for sludge dewatering such as belt filter presses and thickeners, ion exchange for

*(Tramfloc, Inc. cont'd)*

contaminant removal, reverse osmosis, chemical feeding and control, filter gravel and anthracite, tablet chlorination and dechlorination chemicals and systems, filters for potable, pool, waste and process water. The firm handles instrumentation, such as scales, monitors, detectors and alarms. Tramfloc carries flocculants for mining tailings, thickeners and concentrates for precious and base metal mines. The company has an international division which serves its off-shore customers from the Phoenix headquarters.

**Warman International, Inc.**

2701 South Stoughton Road, P.O. Box 7610

Madison, Wisconsin 53707-7610 - USA

**Tel:** 608-221-2261

**Fax:** 609-221-5810

**Web Page:** www.warmanintl.com

**Contact:** Julie Capadona

**E-mail:** generalinfo@warmanintl.com

**Products:** Pumps: Centrifugal and Turbine, Corrosive Liquids, Dredge and Gravel, Sand and Slime, Sump, Blasthole Dewatering.

**Warman International Chile SA**

Avda. Américo Vespucio # 2512

Conchalí, Santiago, Chile

**Tel:** 2-624-1820

**Fax:** 2-624-1812

**Web Page:** www.warmanintl.com

**Contact:**

**E-mail:** generalinfo@warmanintl.com

**Products:** Pumps: Centrifugal and Turbine, Corrosive Liquids, Dredge and Gravel, Sand and Slime, Sump, Blasthole Dewatering.

---

**III. Control de la Erosión y la Sedimentación**

Las perturbaciones mineras exponen el suelo a erosión potencial. Una planificación e implementación cuidadosas pueden mitigar la erosión del suelo y subsecuente sedimentación en arroyos y ríos. Se requiere de medidas y métodos apropiados a cada mina para interceptar, desviar, o de lo contrario reducir el discurso de precipitaciones pluviales proveniente de terrenos de superficie

---

**III. Erosion and Sedimentation Control**

Mining disturbance exposes soil surfaces to potential erosion. Careful planning and implementation can mitigate soil erosion and subsequent sedimentation in streams and rivers. Measures or methods appropriate to each mining situation are required to intercept, divert, or otherwise reduce the stormwater runoff from exposed soil surfaces, tailings facilities, and waste rock dumps. Both vegetative

III ? Control de la Erosión y la Sedimentación  
? Erosion and Sedimentation Control

expuesta, instalaciones de relaves, y depósito para desperdicio de rocas. Las medidas de estabilización vegetativa y no vegetativa son componentes para un control efectivo de la erosión del suelo. Las estructuras de control de la sedimentación (por ejemplo, fuentes de detención/retención) pueden proveerse para interceptar y tratar la pérdida de superficie antes de la descarga. Las instalaciones de control de la erosión y contención de sedimentos, usualmente requieren de mantenimiento apropiado durante la vida del proyecto.

and non-vegetative soil stabilization measures are integral to effective erosion control. Sediment control structures (for example, detention/retention basins) can be provided to intercept and treat surface runoff prior to discharge. Erosion control and sediment containment facilities generally require proper maintenance throughout the project life.

**American Excelsior Company**

850 Avenue H East, P.O. Box 5067  
Arlington, Texas 76005-5067 - USA

**Tel:** 800-777-7645

**Fax:** 817-633-3624

**Web Page:** [www.amerexcel.com](http://www.amerexcel.com)

**Contact:** Steve Walker, Howard Wagner

**E-mail:** [dec\\_esd@hotmail.com](mailto:dec_esd@hotmail.com)

**Products:** Erosion Control Blankets - Curlex, Hydraulic Mulch - Fiber Cel, Sediment Log, Turf Reinforcement Mat (TRM), Articulated Erosion Control System - Tri-Lock.

**Company Statement of Capabilities:** The Earth Science Division of American Excelsior Company is the most experienced producer of erosion control and water management systems in the United States with over 35 years of manufacturing and product applications history. The company established an industry with the introduction of Curlex biodegradable erosion control blanket in 1963. This product has been used successfully in all 50 states and many international locations including Central and South America.

**Armortec**

2853 Meadow Hill Drive, North  
Clearwater, Florida 33761 - USA

**Tel:** 727-726-5790

**Fax:** 727-724-1955

**Web Page:** [www.armortec.com](http://www.armortec.com)

**Contact:** Robert Mohler

**E-mail:** [bscres@earthlink.net](mailto:bscres@earthlink.net)

**Products:** Armorflex, Armorloc, A-Jacks.

**Company Statement of Capabilities:** Armortec provides a variety of products designed to solve a wide range of erosion problems. Products provide protection and stability to slopes

**(Armortec cont'd)**

prone to damage from water runoff. Engineering and site support is available on request. Most questions can be answered in the text of the website.

**Fluid Systems (FSI)**

1245 Corporate Blvd. Suite 300

Aurora, Illinois 60504 - USA

**Tel:** 800-346-9107, 630-898-1161

**Fax:** 630-898-1179

**Web Page:** www.fluidsystems.com

**(Fluid Systems (FSI) cont'd)**

**Contact:** Linda Englander

**E-mail:** fsi@fluidsystems.com

**Products:** Geotextiles, TEX-NET® Geocomposites, TEX-NET® Ultra high flow geocomposites, BENTOFIX® Thermal Lock geosynthetic clay liners, SANI-COVER® daily cover, GoeLok™ cellular confinement system, Strata Grid geogrids, HYDROTEX fabric formed concrete.

**Company Statement of Capabilities:** Fluid Systems is a leading supplier of a wide range of geosynthetics for the waste containment industry, including POLY-NET® drainage nets, TEX-NET® and TEX-NET® ULTRA geocomposites, Bentofix® Thermal Lock GCLs, geotextiles, geogrids, SANI-COVER® daily covers, Hydrotex™ fabric formed concrete and Geolok™ Cellular Confinement System.

**Great Western Chemical Company**

808 S.W. 15th Avenue

Portland, Oregon 97205 - USA

**Tel:** 503-228-2600, 800-547-1400

**Fax:** 503-221-5752

**Web Page:** www.gwchem.com

**Contact:** Taras Warvariv

**E-mail:** taraswarvariv@gwchem.com

**Products:** Powder-emulsion and liquid flocculants, Coagulants-scale and corrosion inhibitors, Viscosity modifiers and equipment packages.

**Company Statement of Capabilities:** Great Western Chemical Company is a United States company with annual sales in excess of \$260MM. We are the 8th largest distributor in North America with an asset base of over \$50MM and have been in business for over 60 years. We have 36 offices/stocking locations throughout USA, Canada, Mexico, China, Russia and presently South America through local partnership-representation. We are a full line chemicals program provider. Our focus is on service, sales, logistical support and complete technical programs for our customers. Our highly trained force includes both mining and metallurgical-environmental engineers supported by our fully staffed technical center. We are well positioned to meet your expectations.

**Hercules Sealcoat MFG., Inc.**

6596 New Peachtree Road

Atlanta, Georgia 30340 - USA

**(Hercules Sealcoat MFG., Inc., cont'd)**

**Tel:** 800-815-7668, 770-455-6551

**Fax:** 770-455-6531

**Contact:** Robin Hotle

**E-mail:** rhotle@aol.com

**Products:** Dust & Erosion Control Agent: Hercules Soiloc MQ.

**Company Statement of Capabilities:** HERCULES SEALCOAT MFG, INC. manufactures dust suppressants at the plant in Doraville, GA, USA. The dust suppressants are used in several different industries including mining, coal, construction, military & equestrian. The product most commonly used in the mining industry is HERCULES SOILOC\_MQ. It is a polymer, liquid, concentrate which is mixed with water before use. It is typically sprayed on loose soil, stockpiles or haul roads or anywhere fugitive dust is a problem.

**KPA International - Enviro Green International**

15912 73rd Avenue, S.E.

Snohomish, Washington 98296 - USA

**Tel:** 425-485-6091; 360-668-7344

**Fax:** 425-485-7999

**Web Page:** www.kpa-envirogreen.com

**Contact:** Frank Porembski

**E-mail:** kpafrank@gte.net

**Products:** Hydroseeding, sprigging and mulching equipment, Seed Machine - Hydro-mulcher, Crimp-Disk, Wood and Paper Fiber Mulch Products, Hydro-Blanket.

**Company Statement of Capabilities:** KPA Enviro Green Int. is the first and largest international distributor of hydroseeding, sprigging and mulching equipment and products. KPA represents the world's largest manufacturer of quality hydromulching equipment, Bowie Manufacturing and the world's largest supplier of high quality wood fiber mulch. KPA was established to assist companies worldwide in becoming effective hydromulchers whether experienced or just beginning. Through KPA Enviro Green Int. companies can obtain materials, equipment, supplies, training, and estimating to succeed in this profession. We are the worldwide distributor of a superior wood fiber mulch, produced by the world's largest and technologically advanced manufacturer of superior fiber mulch. We believe, as do others with extensive experience in hydromulching, that our wood fiber mulch is the most effective planting fiber available in the market today.

**Midwest Industrial Supply, Inc.**

P.O. Box 8431

Canton, Ohio 44711 - USA

**Tel:** 800-321-0699, 330-456-3121

**Fax:** 330-456-3247

**Web Page:** www.midwestind.com

**Contact:** William Melis

**(Midwest Industrial Supply, Inc., cont'd)**

**E-mail:** billm@midwestind.com

*(Midwest Industrial Supply, Inc.cont'd)*

**Products:** Dust & Erosion Control Agent: Polymer - Soil-Sement, MoFoam, etc. for Dust Control & Erosion Control Service, Equipment.

**North American Green, Inc**

14649 Highway 41 North

Evansville, Indiana 47711 - USA

**Tel:** 812-867-6632, 800-772-2040

**Fax:** 812-867-0247

**Web Page:** www.nagreen.com

**Contact:** Greg Deegan

**E-mail:** gdeegan@nagreen.com

**Products:** Erosion Control Blankets.

**Company Statement of Capabilities:** North American Green is the world leader in erosion control, soil and tailings stabilization, and revegetation - reinforcement technology. Design software and CD are available at no charge to design and engineering professionals in English and Spanish.

---

**IV. Estabilización Física**

---

**IV. Physical Stabilization**

---

Generalmente las operaciones mineras requieren la remoción de grandes cantidades de terreno y la construcción de instalaciones sobre una amplia diversidad topográfica, lo que impone un reto importante en el campo de la estabilización física. Algunas de las variables que influyen en el grado de complejidad requerido para la estabilización física incluye el método minero empleado, sea una mina subterránea o de tajo abierto; característica y dureza de las rocas; condiciones del agua subterránea; y condiciones pluviales; entre otros.

Caminos, diques, represas, canales acuáticos y pavimentos son algunas de las aplicaciones de los productos de estabilización física. Tecnología ambiental para la estabilización y pavimentado ha sido desarrollada an años recientes, minimizando el impacto ambiental y alcanzando métodos eficientes en términos de costos, al mismo tiempo.

Mine operations generally require the removal of huge amounts of soil and the construction of facilities over broadly diversified topographies, thus imposing an important challenge in the field of physical stabilization. Some of the variables influencing the degree of complexity required for physical stabilization include the mining method used, whether it is an underground or an open pit mine; rock characteristic and strength; groundwater conditions; and rainfall features; among others.

Roads, dikes, dams, water channels and pavements are some applications for physical stabilization products. Environmentally friendly stabilization and pavement technology have been developed in recent years, minimizing the impact on the environment and achieving cost-effective methods at the same time.

**Georgia Duck & Cordage Mill**

21 Laredo Drive  
Scottsdale, Georgia 30079 - USA  
**Tel:** 404-294-5272  
**Fax:** 404-296-5165  
**Web Page:** www.gaduck.com

**Contact:** Jim Hinson

**E-mail:** jim.hinson@gaduck.com

**Products:** Conveyors, Belts, Components.

**Company Statement of Capabilities:** The Georgia Duck & Cordage Mill has been in business since the turn of the century concentrating in heavy duty industrial textile products. For over 40 years, Georgia Duck has been a leading independent supplier of belting carcass and hose cord. Our customers traditionally have been the major producers of conveyor belts and hose. Today, the majority of the output is absorbed by our own belting operations. Georgia Duck has pioneered many of the developments which make possible the high quality constructions found in today's conveyor belting.

**North American Green, Inc**

14649 Highway 41 North  
Evansville, Indiana 47711 - USA  
**Tel:** 812-867-6632, 800-772-2040  
**Fax:** 812-867-0247  
**Web Page:** www.nagreen.com

**Contact:** Greg Deegan

**E-mail:** gdeegan@nagreen.com

**Products:** Erosion Control Blankets.

**Company Statement of Capabilities:** North American Green is the world leader in erosion control, soil and tailings stabilization, and revegetation – reinforcement technology. Design software and CD are available at no charge to design and engineering professionals in English and Spanish.

---

**V. Control de Contaminacion  
del Aire**

Como una consecuencia de la naturaleza de la actividad minera, el escape de polvo es un resultado inherente de virtualmente toda operación minera. Dependiendo del contenido minero, plomo, arsénico, cadmio y otros minerales pueden ser aerotransportado. Estos minerales representan un peligro importante para la salud humana, animales y la vegetación cuando están presentes en altos niveles de

---

**V. Air Pollution Controls**

As a consequence of the nature of the mining activity, fugitive dust is an inherent outcome of virtually every mining operation. Depending on the mineral content lead, arsenic, cadmium, and other minerals may become airborne. These minerals represent an important threat to human health, animals and vegetation when present in high levels of concentration. Dried tailings surfaces,

concentración. Superficies secas de relaves, trituradores, puntos de transferencia, caminos y superficies no reclamadas expuestas, son las fuentes primarias para la emisión de polvo.

Otra fuente de contaminación del aire son las emisiones de los tubos de escape del equipo minero. Esto tiene un importancia crítica en el caso de operaciones subterráneas porque el monóxido de carbono y el gas de óxido de nitrógeno se concentran y potencialmente puede perjudicar la salud de los trabajadores, al menos que se ventile apropiadamente.

crushers, transfer points, roads and exposed non-reclaimed surface are the primary sources of dust emission.

Another source for air pollution is exhaust emissions from mine equipment. This is of critical importance for underground operations because carbon monoxide and nitrogen oxide gas will concentrate and potentially harm workers' health unless property ventilated.

**Ceilcote Air Pollution Control**

14955 Sprague Rd., Ste 250  
Strongsville, Ohio 44136-1758 - USA

**Tel:** 440-243-0700

**Fax:** 440-243-9854

**Web Page:** [www.ceilcoteapc.com](http://www.ceilcoteapc.com)

**Contact:** Barbara Cicigoi

**E-mail:** [sales@ceilcoteapc.com](mailto:sales@ceilcoteapc.com)

**Products:** Equipment and Systems for Air Pollution Control, FRP Fans, Tellerette packing, Scrubbers, Mist Eliminators, Ionizing Wet Scrubbers, Interel Packaged Scrubbers, DeNOx.

**Company Statement of Capabilities:** Full-service supplier of equipment and systems for air pollution control in corrosive environments. Products include high-efficiency wet scrubbers, ionizing wet scrubbers, industrial low temperature DeNOx, Interel package scrubber systems, centrifugal and axial FRP fans, tower packing and internals, mist eliminators.

**D.R. Technology, Inc.**

73 South Street  
Freehold, New Jersey 07728 - USA

**Tel:** 732-780-4664

**Fax:** 732-780-1545

**Contact:** Richard Schwartz

**E-mail:** [drtchnj@aol.com](mailto:drtchnj@aol.com)

**Products:** Wet Scrubbers.

(D.R. Technology, Inc.)

**Company Statement of Capabilities:** D.R. TECHNOLOGY designs and manufactures equipment used to capture vapors, mists or particles from industrial and municipal vapor emissions. Called "Wet Scrubbers and Absorbers," the units collide contaminated vapors with high volumes of liquid to transfer the contaminants and let the vapor emission exit safely. These designs can remove and neutralize acid vapors such as hydrogen chloride, oxides of sulfur or nitrogen, cyanide gas or ammonia. Fine particles and mists can be captured and occasionally be reused as product. Industries where this technology is in use are mining, smelting, chemical, pulp and paper and wastewater treatment.

**Dust Solutions Incorporated**

PMB # 434, 11919 N. Jantzen Ave.

Portland, Oregon 97217 - USA

**Tel:** 360-546-0072

**Fax:** 360-546-0073

**Web Page:** www.nodust.com

**Contact:** David Gilroy

**E-mail:** adswest@pacifier.com

**Products:** Air Pollution Control Services and System, Dust & Fume Control, Fugitive Dust Control, Dust Suppression Systems, Wind Fence Systems.

**Company Statement of Capabilities:** Manufactures, Designs and Engineers, Dust Suppression Systems for guaranteed compliance with Government Regulations. Featuring Dry Fogging type Agglomerative Dust Suppression Systems using ultrasonic, low water flow nozzles to agglomerate airborne dust. No significant product wetting, chemicals and or freezing to -40 F. Specialist in Mining, Aggregate, Material Handling Industries. Applications include conveyor transfer points, truck and rail dumps, crushers, screens, ship loading and unloading. Also, Wind Fence Systems featuring the DustTamer™ Fabric systems for dump pockets, stock piles and buildings. Free Comprehensive Evaluations. Offices located in USA, Canada, Peru, Chile and Argentina.

**Hercules Sealcoat MFG., Inc.**

6596 New Peachtree Road

Atlanta, Georgia 30340 - USA

**Tel:** 800-815-7668, 770-455-6551

**Fax:** 770-455-6531

**Contact:** Robin Hotle

**E-mail:** rhotle@aol.com

**Products:** Dust & Erosion Control Agent: Hercules Soiloc MQ.

**Company Statement of Capabilities:** HERCULES SEALCOAT MFG, INC. manufactures dust suppressants at the plant in Doraville, GA, USA. The dust suppressants are used in several different industries including mining, coal, construction, military & equestrian. The product most commonly used in the mining industry is HERCULES SOILOC\_MQ. It is a polymer, liquid, concentrate which is mixed with water before

**(Hercules Sealcoat MFG., Inc. cont'd)**

use. It is typically sprayed on loose soil, stockpiles or haul roads or anywhere fugitive dust is a problem.

**Wheelabrator Air Pollution Control Inc.**

441 Smithfield Street

Pittsburgh, Pennsylvania 15222-2292 - USA

**Tel:** 412-562-7300

**Fax:** 412-562-7617

**Web Page:** www.wapc.com

**Contact:** Michael Kozy

**E-mail:** mkozy@wapc.com

**Products:** Air Pollution Control Equipment: Dust Collectors, Fabric Filters, Electrostatic Precipitators, Wet or Dry Scrubbers, FGD Systems, NOx Control, Flue Gas Conditioning.

**Company Statement of Capabilities:** For more than 80 years, Wheelabrator has been a global leader in providing pre-engineered and custom-engineered air pollution control systems and services for a wide variety of industrial and utility applications. A full range of state-of-the-art technologies includes fabric filters, electrostatic precipitators and flue gas conditioning systems for particulate control, wet or dry scrubbers for SO<sub>2</sub> and other acid gas control, systems for NO<sub>x</sub> emission control, and comprehensive Aftermarket Services. Wheelabrator Air Pollution Inc. is a Wheelabrator Technologies company. Wheelabrator technologies Inc. is a wholly-owned subsidiary of Waste Management, Inc.

**A. Control de Descarga de Monteras**

Emisiones aerotransportadas de partículas de materia (PM) pueden ser minimizadas mediante medidas de control y prevención de la contaminación. Prevenir is frecuentemente mas eficiente en términos de costo que controlar. Una variedad de tecnologías para ermosión de partículas están disponibles con distintas características físicas y económicas.

Separadores inerciales o de percisión se apoyan en las propiedades inerciales de las partículas para separarlas del flujo del gas conductor. Los separadores inerciales son usados principalmente para recolectar partículas duras y de tamaño mediano. Incluyen cámaras de reposo y ciclones centrífugos (directo, o el usado con más

**A. Stack Discharge Controls**

Airborne particulate matter (PM) emissions can be minimized by pollution prevention and emission control measures. Prevention is frequently more cost effective than control. A variety of particulate removal technologies are available with different physical and economic characteristics.

Inertial or impingement separators rely on the inertial properties of the particles to separate them from the carrier gas stream. Inertial separators are primarily used for the collection of medium-sized and coarse particles. They include settling chambers and centrifugal cyclones (straight-through, or the more frequently used reverse-flow cyclones). Cyclones are low-cost, low

frecuencia, ciclone de flujo invertido). Los ciclones son colectores centrífugos de bajo costo y bajo mantenimiento, que típicamente son usados para remover partículas con un rango de tamaño de 10-100 micrones. La eficiencia de los ciclones en la remoción de polvo fino se ubica típicamente por debajo de 70 por ciento comparado con precipitadores electrostáticos (ESPs) y los filtros en forma de bolsa que pueden tener una eficiencia de 99 por ciento o más. Por lo tanto, los ciclones son a menudo usados como un paso inicial hacia otro mecanismo de remoción de PM.

Los precipitadores electrostáticos (ESPs) remueven partículas mediante el uso de un campo electrostático para atraer las partículas hacia los electrodos. Las eficiencias de recolección para sistemas bien diseñados, operados y mantenidos se ubican típicamente en el orden de 99.9 por ciento o más de la carga de polvo ingresada. Son especialmente eficientes recolectando partículas finas y también pueden capturar vestigios de emisión de algunos metales tóxicos con una eficiencia de 99 por ciento. Los ESPs son menos sensibles a temperaturas máximas que filtros de tela y operan con caídas de baja presión. El consumo de electricidad es similar a aquéllos que usan filtros de tela. El funcionamiento de los ESPs es afectado por la carga de ceniza, la resistencia de la carga de ceniza, y el contenido de sulfuro del combustible. Bajas concentraciones de sulfuro en el combustible pueden llevar a un decremento en la eficiencia de recolección. Los ESPs han sido empleados para la recuperación de materiales procesados así como para el control de la contaminación.

Los filtros y los recolectores de polvo (**baghouses**) recolectan el polvo pasando

maintenance centrifugal collectors, which are typically used to remove particulates in the size range of 10-100 microns. The fine dust-removal efficiency of cyclones is typically below 70 percent compared to electrostatic precipitators (ESPs) and baghouses that can have removal efficiencies of 99.9 percent or more. Therefore, cyclones are often used as a primary stage to other PM removal mechanisms.

Electrostatic precipitators (ESPs) remove particulates by using an electrostatic field to attract the particles onto the electrodes. Collection efficiencies for well-designed, well-operated, and well-maintained systems are typically in the order of 99.9 percent or more of the inlet dust loading. They are especially efficient in collecting fine particles and can also capture trace emissions of some toxic metals with an efficiency of 99 percent. ESPs are less sensitive to maximum temperatures than fabric filters, and operate with very low-pressure drop. Their consumption of electricity is similar to those of fabric filters. ESP performance is affected by fly-ash loading, the resistance of fly-ash loading, and the sulfur content of the fuel. Lower sulfur concentrations in the flue gas can lead to a decrease in the collection efficiency. ESPs have been used for the recovery of process materials as well as for pollution control.

Filters and dust collectors (baghouses) collect dust by passing flue gases through a fabric filter. The most commonly used is the bag filter or baghouse. The various types of filter media include woven fabric, needled felt, plastic, ceramic and metal. The baghouse operating temperature influences the choice of fabric. Accumulated particles are removed by mechanical shaking, reversal of the gas

los gases de los ductos a través de un filtro de tela. El filtro en forma de bolsa o **baghouse** es el de mayor uso. Los diversos tipos de materiales usados en filtros, incluyen tela de lana, **fieltro de agujas**, plástico, cerámica y metal. La temperatura de operación de los **baghouses** influencia la selección de la tela. Las partículas acumuladas son removidas con sacudidas mecánicas, invirtiendo el flujo del gas o una corriente de aire a alta presión. Los filtros de tela son eficientes (99 por ciento de remoción) tanto para baja como alta concentración de partículas, pero son adecuados sólo para partículas sueltas y secas. La eficiencia en la remoción de metales tóxicos como arsénico, cadmio, cromo, plomo y níquel es mayor a 99 por ciento. También tienen el potencial de mejorar la captura de dióxido de sulfuro en instalaciones posteriores a la inyección (**sorbent**) y los sistemas de depuración en seco.

Los depuradores húmedos se valen de un rociador de líquidos para remover las partículas de polvo del flujo de gas. Ellos son usados principalmente para remover emisiones gaseosas, siendo el control de partículas una función secundaria. Los tipos principales de depuradores venturi, depuradores a chorro (humo) y torres de rociadores o cámaras. Los depuradores venturi consumen grandes cantidades de líquido depurador (como el agua) y energía eléctrica e incurren en caídas de alta presión. Secadores a chorro o de humo, se apoyan en la energía cinética del flujo líquido. La típica eficiencia de remoción de un depurador a chorro o de humo (para partículas de 10 micrones o menos) es menor al de los depuradores venturi. Las torres de rociar pueden manejar flujos de gas con caídas de presión mínima; por lo tanto ellos son a menudo usados como enfriadores previos.

flow, or a stream of high-pressure air. Fabric filters are efficient (99.9 percent removal) for both high and low concentrations of particles, but are suitable only for dry and free-flowing particles. Their efficiency to remove toxic metals such as arsenic, cadmium, chromium, lead and nickel is greater than 99 percent. They also have the potential to enhance the capture of sulfur dioxide in installations downstream of sorbent injection and dry scrubbing systems.

Wet scrubbers rely on a liquid spray to remove dust particles from a gas stream. They are primarily used to remove gaseous emissions, with particulate control as a secondary function. The major types are venturi scrubbers, jet (fume) scrubbers, and spray towers or chambers. Venturi scrubbers consume large quantities of scrubbing liquid (such as water) and electric power, and incur high-pressure drops. Jet or fume scrubbers rely on the kinetic energy of the liquid stream. The typical removal efficiency of a jet or fume scrubber (for particles 10 microns or less) is lower than that of a venturi scrubber. Spray towers can handle larger gas flows with minimal pressure drop; therefore they are often used as pre-coolers. Wet scrubbers may contribute to corrosion; therefore, removal of water from the effluent gas of the scrubbers may be necessary. Also, scrubbing results in a liquid effluent. Wet scrubbing technology is used where: (i) the contaminant cannot be removed easily in a dry form; (ii) soluble gases are present; (iii) wettable particles are present; and (iv) the contaminant will undergo some subsequent wet process (such as recovery, wet separation or settling, or neutralization).

Los depuradores húmedos pueden contribuir a la corrosión; por lo tanto, la remoción del agua del gas efluente puede ser necesaria. La depuración también resulta en un efluente líquido. La tecnología de depuradores húmedos se usa cuando: (i) el contaminante no puede ser removido fácilmente en forma seca, (ii) gases solubles están presentes; (iii) Partículas mojables están presentes; y (iv) el contaminante pasará por algún proceso húmedo posteriormente (tal como recuperación, separación húmeda o reposo, o neutralización).

### **B. Control de Escapes de Polvo**

La erosión eólica es un factor que puede crear escapes de polvo provenientes de las superficies de los relaves secos. En muchas instancias, este polvo puede ser molesto o peligroso para el medio ambiente o la salud humana y necesita ser controlado.

Una amplia gama de metodologías de control están disponibles incluyendo el desarrollo de buenas cubiertas vegetales, la colocación de material granular resistente al viento y rociadores de elementos adherentes para formar una corteza resistente a la erosión. La practicidad de uso depende del acceso que se requiere a los relaves para ubicar los productos para el control del polvo. La naturaleza blanda de los relaves de lodo a menudo evita el ingreso de vehículos pesados. Esto limita los agentes que pueden ser usados frente a los que pueden ser aplicados con equipo muy liviano o por rociadores de mano.

Dado que la escorrentía de los relaves va idealmente hacia el estanque de agua de relave, el cual puede ser descargado, es importante que los agentes sean insolubles

### **B. Fugitive Dust Controls**

Wind erosion is a factor that can create fugitive dust from dry tailings surfaces. In many instances this dust can be an annoyance or hazardous to the environment or human health and needs to be controlled.

A wide range of control methodologies are available including the development of good vegetative cover, the placement of granular wind resistant materials and the spraying of bonding agents to form an erosion resistant crust. The practicality of use is dependent on the access that is required onto the tailings in order to place the dust control measures. The soft nature of the tailings slimes often precludes access by heavy vehicles. This limits the agents that can be used to those that can be applied using very light equipment or by hand held sprayers.

Since run-off from the tailings is ideally into tailings pond water, which may be discharged, it is important that spray agents be insoluble or that they contain no harmful substances that could contaminate the pond water.

Fugitive dust must also be controlled at: crushers, conveyors, transfer points, rotary dumpers, loading and unloading sites, and on unpaved roads.

o que no contengan elementos dañinos que  
puden contaminar el agua del estanque.

Los escapes de polvo deben también ser  
controlados en: trituradores,  
transportadores, puntos de transferencia,  
depósitos rotatorios, sitios de carga y  
descarga y caminos sin pavimentar.

**Midwest Industrial Supply, Inc.**

P.O. Box 8431

Canton, Ohio 44711 - USA

**Tel:** 800-321-0699, 330-456-3121

**Fax:** 330-456-3247

**Web Page:** www.midwestind.com

**Contact:** William Melis

**E-mail:** billm@midwestind.com

**Products:** Dust & Erosion Control Agent: Polymer - Soil-Sement, MoFoam, etc. for Dust  
Control & Erosion Control Service, Equipment.

**National Filter Media Corporation**

8895 Deerfield Drive

Olive Branch, Mississippi 38654 - USA

**Tel:** 800-826-6250, 601-895-4660

**Fax:** 601-895-4968

**Contact:** J.A. Anglin

**Products:** Air Filtration: Pulse jet bags, Bags for shaker and reverse air filters, Envelope type  
bags, Cartridge filters, glass bags; Liquid filtration; Hardware: Cages, clamps &  
venturis, Gasketing materials, pressure filter leaves, wire cloth, duplex filter plates.

**Company Statement of Capabilities:** National Filter Media manufactures filter bags for  
baghouse dust collectors and liquid filter media for vacuum and present filters. The  
fabrics we supply include cotton, polyester, polypropylene, Nomex Aramid, Ryton  
PPS, P84, PTFE. We also manufacture a complete line of monofilament and  
multifilament, woven fabric for press filters, disc sector bags, vacuum filter belts,  
drum filter covers and pressure leaf filters. We are the oldest and largest suppliers of  
filter media to the mining industry in North America. Our clients include copper  
mines, iron ore mines, gold mines and many other mining companies.

---

## VI. Remediaci3n

La remediaci3n incluye la limpieza y otros m3todos usados para remover o contener derrames t3xicos o materiales peligrosos de un sitio minero. Las actividades de remediaci3n usualmente comienzan con una evaluaci3n de la naturaleza y extensi3n de la contaminaci3n en un sitio espec3fico. Basado en los resultados de la evaluaci3n, se planea el dise1o de la remediaci3n, describiendo detalles ingenieriles y especificaciones para la limpieza.

### **Georgia Duck & Cordage Mill**

21 Laredo Drive

Scottdale, Georgia 30079 - USA

**Tel:** 404-294-5272

**Fax:** 404-296-5165

**Web Page:** [www.gaduck.com](http://www.gaduck.com)

**Contact:** Jim Hinson

**E-mail:** [jim.hinson@gaduck.com](mailto:jim.hinson@gaduck.com)

**Products:** Conveyors, Belts, Components.

**Company Statement of Capabilities:** The Georgia Duck & Cordage Mill has been in business since the turn of the century concentrating in heavy duty industrial textile products. For over 40 years, Georgia Duck has been a leading independent supplier of belting carcass and hose cord. Our customers traditionally have been the major producers of conveyor belts and hose. Today, the majority of the output is absorbed by our own belting operations. Georgia Duck has pioneered many of the developments which make possible the high quality constructions found in today's conveyor belting.

### **North American Green, Inc.**

14649 Highway 41 North

Evansville, Indiana 47711 - USA

**Tel:** 812-867-6632, 800-772-2040

**Fax:** 812-867-0247

**Web Page:** [www.nagreen.com](http://www.nagreen.com)

**Contact:** Greg Deegan

**E-mail:** [gdeegan@nagreen.com](mailto:gdeegan@nagreen.com)

**Products:** Erosion Control Blankets.

**Company Statement of Capabilities:** North American Green is the world leader in erosion control, soil and tailings stabilization, and revegetation - reinforcement technology. Design software and CD are available at no charge to design and engineering professionals in English and Spanish.

---

## VI. Remediation

Remediation includes cleanup or other methods used to remove or contain toxic spills or hazardous materials from a mine site. Remediation activities usually start with an assesment of the nature and extent of contamination at a particular site. Based on the results of the assesment a remedial desing is planned, describing engineering details and specifications for cleanup.

### **A. Suelos**

La bioremediación es una tecnología amigable al medio ambiente (natural) y efectiva en términos de costo, que destruye los contaminantes orgánicos y elimina los efectos sobre la salud y la ecología, así como obligaciones futuras. Las tecnologías de tratamiento biológicos están encontrando amplio apoyo del público y de las agencias reguladoras para remediación de lugares. La bioremediación del suelo puede ser llevada a cabo mediante la adición de nutrientes, utilizando bacterias del lugar, o mediante la adición de otros nutrientes y bacterias.

### **A. Soils**

Bioremediation is an environmentally friendly (natural) cost effective technology that destroys organic pollutants and eliminates health and ecological effects as well as future liabilities. Biological treatment technologies are finding widespread public and regulatory agency support for site remediation.

Bioremediation of soils can be accomplished by the addition of nutrients utilizing existing indigenous bacteria, or by the addition of other nutrients and bacteria.

### **Applied Surface Technologies AST Coatings Applied**

1423 West Ormsby Avenue

Louisville, Kentucky 40210 - USA

**Tel:** 502-634-9458

**Fax:** 502-634-1130

**Web Page:** [www.astl.com](http://www.astl.com)

**Contact:** Dave McEwan

**E-mail:** [tech@astl.com](mailto:tech@astl.com)

**Products:** Surface Coatings - ElectroFin, Bio Technology for cleaning.

**Company Statement of Capabilities:** AST applies high performance coatings to prevent corrosion of fin and tube heat exchangers. AST also sells cleaning systems for bacterial films (green slime) often present on heat exchangers or other surfaces.

### **Klean Earth Environmental Company (KEECO)**

19023 36th Avenue West, Suite E

Lynnwood, Washington 98036 - USA

**Tel:** 425-778-7165

**Fax:** 425-778-7564

**Web Page:** [www.keeco.com](http://www.keeco.com)

**Contact:** Jim Rybock

**E-mail:** [info@keeco.com](mailto:info@keeco.com)

**Products:** Silica Micro Encapsulation (SME) Technology, KB-1, KB-SEA and META-LOCK.

**Company Statement of Capabilities:** KEECO developed the Silica Micro Encapsulation (SME) technology for the treatment and pollution prevention of heavy metals and radionuclides in waters, soils, and sludges. Using a silica-based chemical formulation that entails chemisorption and micro-encapsulation of contaminants in a permanent silica matrix, encapsulated particles settle quickly and are effectively isolated from the

***(Klean Earth Environmental Company (KEECO) cont'd)***

surrounding environment, producing a stable, non-hazardous sludge. In a number of independently-verified bench and field-scale applications at major mining operations, KEECO's SME has proven more efficient and cost-effective than conventional technologies (e.g. lime) in treatment of acid mine drainage. The SME technology provides complete control of heavy metals.

**North American Green, Inc**

14649 Highway 41 North  
Evansville, Indiana 47711 - USA  
**Tel:** 812-867-6632, 800-772-2040  
**Fax:** 812-867-0247

**Web Page:** www.nagreen.com

**Contact:** Greg Deegan

**E-mail:** gdeegan@nagreen.com

**Products:** Erosion Control Blankets.

**Company Statement of Capabilities:** North American Green is the world leader in erosion control, soil and tailings stabilization, and revegetation - reinforcement technology. Design software and CD are available at no charge to design and engineering professionals in English and Spanish.

**B. Cultivo de la Tierra**

El cultivo de la tierra es una técnica de bioremediación utilizada para suelos contaminados cuando hay suficiente espacio disponible en el lugar, o puede ser ejecutado en una ubicación fuera del sitio. El suelo es escabado y extendido hasta una profundidad de 1 o 2 pies. Las bacterias, nutrientes y condicionantes del suelo son agregadas, dependiendo de las condiciones iniciales del suelo. La extensa área de la superficie y el labrado del suelo facilitan el flujo del oxígeno hacia los microorganismos, promoviendo la degradación rápida y eficiente del contaminante.

**B. Land farming**

Land farming is a bioremediation technique used for contaminated soils when there is sufficient space available on site, or it can be performed at an off-site location. The soil is excavated and spread to a depth of 1 to 2 feet. Bacteria, nutrients and soil conditioners are added, depending on the initial soil conditions. The large surface area and tilling of the soil facilitate oxygen flow to the microorganisms, promoting rapid and efficient contaminant degradation.

---

**VII. Manejo/Control de  
Materiales Peligrosos y  
Desperdicios**

---

Otras fuentes importantes de contaminación son las aguas residuales y los químicos que quedan luego de la limpieza y el mantenimiento del equipo y las instalaciones. Dos grupos pueden ser identificados: aguas residuales o soluciones a base de agua y materiales peligrosos. El primero se refiere a las soluciones contenidas en el agua usada para limpiar el equipo, los camiones y las instalaciones. El segundo se refiere a las soluciones que no están basadas en agua, tales como aceites, grasas, solventes, fluidos de maquinaria y pinturas, todo los cuales son usados para proporcionar mantenimiento al equipo o limpiar partes. En general, la meta es reducir la cantidad de agua usada para actividades de limpieza, reciclar el agua usada, separar materiales peligrosos y tratarlos antes de su eliminación o reciclaje.

---

**VII. Hazardous Materials and  
Waste Management/  
Controls**

---

Another important source of pollution is the wastewater and chemicals remaining after cleaning and maintaining equipment and facilities. Two groups can be identified: wastewater or water-based solutions and hazardous materials. The first one refers to the solutions imbedded in the water used to clean equipment, trucks and facilities. The second one refers to solutions that are not water-based such as oil, grease, solvents, machinery fluids and paints all of which are used to provide maintenance to the equipment or to clean parts. In general, the goal is to reduce the amount of water used for cleaning activities, recycle the water used, separate hazardous materials and treat them before disposal or recycle them.

**Athey Products Corporation**

1839 South Main Street

Wake Forest, North Carolina 27587 - USA

**Tel:** 919-556-5171

**Fax:** 919-556-0122

**Web Page:** [www.athey.com](http://www.athey.com)

**Contact:** N. Anthony Wakim

**E-mail:** [nawakim@athey.com](mailto:nawakim@athey.com)

**(Athey Products Corporation cont'd)**

**Products:** Conveyors: Belt, Dewatering, Loading boom and stacker, Movable, shaking and vibrating.

**Company Statement of Capabilities:** Athey Products Corporation is the leading U.S. manufacturer of a complete line of mechanical and generative air Mobil Sweepers for municipal and airport applications. Athey also manufactures belt loading equipment. Athey Products Corporation (World Headquarters located in Wake Forest, North Carolina, USA) has been in business for 77 years.

**Belt Maintenance Group**

240 Seneca Street

Buffalo, New York 14204 - USA

**Tel:** 716-852-0832

**Fax:** 716-852-4198

**Web Page:** www.beltmaintenance.com

**Contact:** Ron Fernandes, David Miller

**E-mail:** ronfernandes@worldnet.att.net; davemillerbmg@worldnet.att.net

**Products:** Conveyor Belts, Belt Repair and Splicing Services, Conveyor System Inspection, Idlers, Pulleys, Skirting, Chute Linings, Belt Cleaners and Repair Products.

**Company Statement of Capabilities:** The Belt Maintenance Group is an industry leader in conveyor belt installation and repair. BMG offers a full range of conveyor system products in addition to its conveyor related services. Full system analysis, inspections, and consultation services are provided to improve conveyor productivity and to minimize spillage and pollution. With nine US-based branches, BMG offers direct service and products to conveyor system users throughout the world. BMG specializes in servicing fabric carcass belt, steel cord belt, corrugated sidewall belt, HAC, filter belt and other belt systems. The Belt Maintenance Group services are approved by all major belt manufacturers.

**Continental Conveyor & Equipment Company**

P.O. Box 400

Winfield, Alabama 35594 - USA

**Tel:** 205-487-6492

**Fax:** 205-487-4233

**Web Page:** www.continentalconveyor.com

**Contact:** Greg Chaffin

**E-mail:** info@continentalconveyor.com

**Products:** Bulk Materials Handling Equipment, Conveyors, Components.

**Creative Engineering Company**

3513 Century Drive

Bakersfield, California 93306-1238 - USA

**Tel:** 661-872-4763

**Fax:** 661-871-1798

**Web Page:** www.suverkrop.com

**(Creative Engineering Company cont'd)**

**Contact:** Don Suverkrop

**Products:** Belts, Conveyors, Components, Suverhoist, Engineering Design Consulting.

**Company Statement of Capabilities:** Creative Engineering works to advance the application of belt conveyors in general but with a special interest in applications involving open pit mining operations. Belt conveyors move material very efficiently using electric power. Pollution is either non-existent or can be more readily controlled using present technology at a central power station.

**Inland Technology Incorporated**

401 East 27th Street

Tacoma, Washington 98421 - USA

**Tel:** 800-552-3100, 253-383-1177

**Fax:** 253-593-8749

**Web Page:** [www.inlandtech.com](http://www.inlandtech.com)

**Contact:** Eric Lethe

**E-mail:** [inland@inlandtech.com](mailto:inland@inlandtech.com)

**Products:** Parts Washer System and Solvents.

**Company Statement of Capabilities:** Inland Technology Incorporated has designed substitutes for 1,1,1, Trichloroethane, Freon 113, and Methyl Ethyl Ketone for clients as diverse as The Boeing Co., Hewlett-Packard, Rockwell International, and Westinghouse. Our scientists and engineers enjoy a national and international reputation for expertise in the areas of Solvent Substitution and Source Reduction.

**Klean Earth Environmental Company (KEECO)**

19023 36th Avenue West, Suite E

Lynnwood, Washington 98036 - USA

**Tel:** 425-778-7165

**Fax:** 425-778-7564

**Web Page:** [www.keeco.com](http://www.keeco.com)

**Contact:** Jim Rybock

**E-mail:** [info@keeco.com](mailto:info@keeco.com)

**Products:** Silica Micro Encapsulation (SME) Technology, KB-1, KB-SEA and META-LOCK.

**Company Statement of Capabilities:** KEECO developed the Silica Micro Encapsulation (SME) technology for the treatment and pollution prevention of heavy metals and radionuclides in waters, soils, and sludges. Using a silica-based chemical formulation that entails chemisorption and micro-encapsulation of contaminants in a permanent silica matrix, encapsulated particles settle quickly and are effectively isolated from the surrounding environment, producing a stable, non-hazardous sludge. In a number of independently-verified bench and field-scale applications at major mining operations, KEECO's SME has proven more efficient and cost-effective than conventional technologies (e.g. lime) in treatment of acid mine drainage. The SME technology provides complete control of heavy metals.

**Rocky Mountain Remediation Service, L.L.C.**

1819 Denver West Drive, Building 26, Suite 100

Golden, Colorado 80401 - USA

**Tel:** 303-215-6620

**Fax:** 303-215-6720

**Web Page:** [www.ebond-ebtric.com/ebtechlinks.html](http://www.ebond-ebtric.com/ebtechlinks.html)

**Contact:** Jim Barthel

**E-mail:** [jbarthel@rmrshq.com](mailto:jbarthel@rmrshq.com)

**Products:** Envirobond ARD for Acid Rock Drainage, Envirobond for contamination in soils, Envirobond CD for cadmium, Enviro Waste Capping System

**(Rocky Mountain Remediation Service, L.L.C. cont'd)**

VIII ? Monitoreo de Aire, Agua Residual y Corrient Efluente  
? Monitoring Air, Wastewater, and Effluents

**Company Statement of Capabilities:** Rocky Mountain Remediation Services' Envirobond™ technology employs a proprietary family of chemicals that converts heavy metals to stable, metal compounds and stops acid rock drainage (ARD). Envirobond™ ARD – Treats Acid Rock Drainage: A treatment for acid rock drainage that stops the generation of acid and transport of metals. Envirobond™ - Treats Metals Contamination In Soil: Envirobond™ eliminates the leachability of metals in soils. Envirobond™ CD - Sludge Treatment: Envirobond™ CD is a chemical treatment system for hazardous metallic sludges. Envirobond™ Waste Capping System: The Envirobond™ Waste Capping System creates an inexpensive, low permeability, low porosity, erosion resistant cap.

**Sioux Rubber Applicators, Inc.**

2620 Hawkeye Drive

Sioux City, Iowa 51105 - USA

**Tel:** 800-443-9469, 712-252-3257

**Fax:** 712-252-3258

**Web Page:** [www.infomine.com/index/suppliers/Sious\\_Rubber\\_Applicators,\\_Inc.html](http://www.infomine.com/index/suppliers/Sious_Rubber_Applicators,_Inc.html)

**Contact:** Jon Wren

**E-mail:** soorubr@aol.com

**Products:** Abrasion Resistant Surfaces, Conveyors, Belts, Components.

---

**VIII. Monitoreo de Aire, Agua Residual y Corriente Efluente**

---

La vigilancia o prueba periódica o continua para determinar el nivel de los contaminantes es uno de los aspectos más importantes de las operaciones mineras. El monitoreo del aire es una de las actividades diarias que puede ayudar a eliminar o reducir substancialmente futuras obligaciones debido a elevados niveles de contaminantes que puedan afectar a humanos, plantas y animales.

El contenido así como la calidad del agua residual necesita ser monitoreada para determinar su composición física, química o biológica. Así, datos sobre la cantidad, tipos y distribución de contaminantes determinarán las técnicas más adecuadas que necesitan ser aplicadas para neutralizar los componentes activos y/o aislar partículas potencialmente peligrosas

---

**VIII. Monitoring Air, Wastewater and Effluents**

---

The periodic or continuous surveillance or testing to determine the level of pollutants is one of the most important aspects in mining operations. Air monitoring is part of the day-to-day activities that may help eliminate or substantially reduce future liabilities due to high levels of pollutants that may affect humans, plants, and animals.

The content as well as the quality of wastewater needs to be monitored in order to determine its physical, chemical, or biological composition. Thus, data about the amounts, types, and distribution of contaminants will determine the most suitable techniques that need to be applied in order to neutralize active components and/or isolate all potentially dangerous particles and materials from wastewater.

y materiales provenientes del agua residual.

Una de la expresiones más comunes de la contaminación son las corrientes efluentes, las que pueden incluir escorrentería o agua residual que son descargadas en aguas superficiales. Si las corrientes efluentes no son manejadas apropiadamente, serias obligaciones pueden aparecer, consumiendo valiosos recursos de las empresas mineras.

One of the most common expressions of pollution are effluents, which may include water runoff or wastewater that are discharged into surface waters. If effluents are not managed properly, serious liabilities may arise, consuming valuable resources of mining companies.

### **Entek IRD International Corporation**

1700 Edison Drive

Milford, Ohio 45150 - USA

**Tel:** 513-576-6151 (US) / 51-1-222-0064 (Peru)

**Fax:** 513-5766104 (US) / 51-1-421-0302 (Peru)

**Web Page:** [www.entekird.com](http://www.entekird.com)

**Contact:** Rick W. Carlisle (US) / Augusto de la Piedra (Peru)

**E-mail:** [rcarlisle@entekird.com](mailto:rcarlisle@entekird.com) (US) / [postmast@iisaap.com.pe](mailto:postmast@iisaap.com.pe) (Peru)

**Products:** Conditioning monitoring vibration and analytical software, vibration data collectors, vibration and process parameters monitors, balancing machines, balancing instruments, on-site oil analysis software and data collectors and sampling devices for particle counts, ferrous particle count, and viscosity.

### **Geosonics Inc./Vibra-Tech**

P.O. Box 779

Warendale, Pennsylvania 15095 - USA

**Tel:** 724-934-2900

**Fax:** 724-934-2999

**Web Page:** [www.geosonics.com](http://www.geosonics.com)

**Contact:** Phil Berger

**E-mail:** [geosonic@iglou.com](mailto:geosonic@iglou.com)

**Products:** Blasting Seismographs, Vibration Monitors, Blasting Consulting, Vibration Prediction and Control Studies

**Company Statement of Capabilities:** GeoSonics and its sister company, Vibra-Tech, comprise the largest vibration consulting company and seismograph manufacturing company in the United States. Their various vibration and acoustic services reduce the likelihood of structural damage, physical harm, and public annoyance resulting from man-made sources of vibrations and noise. These sources include blasting, pile driving, tunneling, heavy construction, traffic, and industrial equipment. In addition, the different portable seismographs that are manufactured by GeoSonics are utilized by operators to verify compliance with applicable vibration and/or noise regulations and to allay the safety

IX ? Manejo de Relaves  
? Tailings Management

**(Geosonics Inc./Vibra-Tech cont'd)**

concerns of the public. GeoSonics' clients include quarries, mining companies, construction companies, engineering/consulting companies, regulatory agencies, and universities.

**Tytronics, A Metrisa Company**

25 Wiggins Avenue

Bedford, Massachusetts 01730-2323 - USA

**Tel:** 800-370-2345, 781-275-9660(ext. 258)

**Fax:** 781-275-9665

**Web Page:** www.tytronics.com

**Contact:** Dr. Eric F. Mooney

**E-mail:** efmooney@aol.com, info@tytronics.com

**Products:** Process titrators, colorimeters, ISE analyzers and transmission photometers for the UV and visible regions.

**Company Statement of Capabilities:** Tytronics, A Metrisa Company, is one of the leading companies with the capability of measuring a whole range of metallic and non-metallic components in wastewater, as well as making process measurements for the process control and optimization of the mining operation.

**Western Environmental Services & Testing, Inc.**

913 Foster Road

Casper, Wyoming 82601 - USA

**Tel:** 800-545-5711, 307-234-5511

**Fax:** 307-234-8324

**Web Page:** www.hawksindustries.com

**Contact:** James E. Meador, Jr.

**E-mail:** west\_wy@trib.com

**Products:** Air Monitoring Services.

---

**IX. Manejo de Relaves**

Dependiendo de la técnica minera empleada, las compañías mineras pueden tener que afrontar relaves como parte de sus operaciones. Los relaves consisten en desperdicios, material granulado finamente y agua separada del proceso de extracción del mineral. El reto impuesto a la administración y los recursos que se requieren para un manejo adecuado de los relaves, depende principalmente de la composición minera del relave. Los temas ambientales relacionados con el manejo

---

**IX. Tailings Management**

Depending on the mining technique used mining companies may deal with tailings as part of their operations. Tailings consist of waste, fine grained material and water separated out during the processing of extracting mineral ores. The challenge imposed on management and the resources required to manage tailings adequately depend mainly on the mineral composition of the tailings. The environmental issues regarding improperly managed tailings are related to acid mine drainage, visual

inapropiado de los relaves, están relacionados con el drenaje ácido de minas, impacto visual, estabilidad, contaminación del aire, contaminación del agua, etc.

impact, stability, air pollution, water pollution, etc.

**Baker Process, division of Baker Hughes Inc.**

669 West 200 South Street P.O. Box 300

Salt Lake City, Utah 84110 - USA

**Tel:** 801-526-2909

**Fax:** 801-526-2923

**Contact:** Frank Baczek

**E-mail:** Frank.Baczek@bakerhughes.com

**Products:** Clarifiers, Thickeners, Filters, Flotation Cells, Column Flotation Cells.

**Company Statement of Capabilities:** Baker Process offers a wide range of equipment for solid-liquid applications proven over decades of dependable service. This range of equipment originates both from internal research and development and from external licenses of major worldwide process equipment designers. Baker Process is a division of Baker Hughes Inc. and is organized to effectively and efficiently serve a truly worldwide industry from four geographic operating regions. Baker Process maintains a comprehensive range of technology, design, engineering and manufacturing capabilities. A single piece of equipment or a complete process plant designed, supplied, erected and commissioned on a turn-key basis can be provided.

**Coeur d'Alene Mines Corporation**

505 Front Avenue, P.O. Box 1

Coeur D'Alene, Idaho 83816-0316 - USA

**Tel:** 208-667-3511

**Fax:** 208-667-2213

**Web Page:** www.coeur.com

**Contact:** Luke Russell

**E-mail:** lrussell@coeur.com

**Products:** Cyanisorb™ technology recovers cyanide directly from gold mill tailings for recycle back to leaching circuit; removes cyanide prior to disposal of tailing, average recovery is 80-90 percent, with plant operating costs offset by the value of the recovered.

**Company Statement of Capabilities:** Coeur d'Alene Mines Corp. is North America's leading low-cost primary silver producer and a significant gold producer with interests in Nevada, Idaho, Alaska, Chile, Australia and Bolivia. Recognized as a leader in environmental stewardship, Coeur has received 19 environmental awards for leadership and commitment to environmental protection over the last decade.

**GeoTDR, Inc.**

297 Pinewood Drive

Apple Valley, Minnesota 55124 - USA

**Tel:** 612-431-3415

IX ? Manejo de Relaves  
? Tailings Management

**(GeoTDR, Inc. cont'd)**

**Fax:** 612-892-0241

**Web Page:** www.geotdr.com

**Contact:** Kevin O'Connor

**E-mail:** kevin@geotdr.com

**Products:** Monitoring Equipment

**Company Statement of Capabilities:** GeoTDR, Inc. is dedicated to achieving high levels of customer satisfaction and financial performance by transforming innovative TDR technology into reliable cost-effective solutions to customer problems. GeoTDR personnel have been involved with TDR technology since 1982 with particular emphasis on geotechnical, mining and environmental applications. These applications have included: 1) monitoring subsidence over active and abandoned mines, 2) monitoring highwall, landslide and embankment slope movement, 3) monitoring ground water levels and contaminants, and 4) monitoring consolidation of mine tailings. A comprehensive summary of applications is provided in the book, "GeoMeasurements by Pulsing TDR Cables and Probes." (CRC Press, ISBN 0-8493-0586-1).

**Great Western Chemical Company**

808 S.W. 15th Avenue

Portland, Oregon 97205 - USA

**Tel:** 503-228-2600, 800-547-1400

**Fax:** 503-221-5752

**Web Page:** www.gwchem.com

**Contact:** Taras Warvariv

**E-mail:** taraswarvariv@gwchem.com

**Products:** Powder-emulsion and liquid flocculants, Coagulants-scale and corrosion inhibitors, Viscosity modifiers and equipment packages.

**Company Statement of Capabilities:** Great Western Chemical Company is a United States company with annual sales in excess of \$260MM. We are the 8th largest distributor in North America with an asset base of over \$50MM and have been in business for over 60 years. We have 36 offices/stocking locations throughout USA, Canada, Mexico, China, Russia and presently South America through local partnership-representation. We are a full line chemicals program provider. Our focus is on service, sales, logistical support and complete technical programs for our customers. Our highly trained force includes both mining and metallurgical-environmental engineers supported by our fully staffed technical center. We are well positioned to meet your expectations.

**HY - TRAN, INC.**

P.O. Box 279

Stoughton, Wisconsin 53589-0279 - USA

**Tel:** 608-877-9201

**Fax:** 608-877-9204

**Contact:** Ross Jahn

**E-mail:** hytranmds@aol.com

**(HY - TRAN, INC. cont'd)**

**Products:** Pump Flotation Systems - Pump Floats, Dirty Water/Slurry Transfer, Dewatering, Floating Pipelines

**Company Statement of Capabilities:** Hy-Tran, Inc. is a supplier of custom designed floating pumping systems as well as portable, land based clean water, dirty water or slurry pumping systems. We can float any style or brand of pump/motor combination, new or used. Underground, open cast and pond dewatering is a specialty using centrifugal slurry pumps. Hydraulic mining eductors and monitors are also designed and supplied. All fabrications are designed for shipping container transport to jobsites.

**The Gorman-Rupp Company**

305 Bowman Street, P.O. Box 1217

Mansfield, Ohio 44901-1217 - USA

**Tel:** 419-755-1011, 419-755-1350, 419-755-1352

**Fax:** 419-755-1266

**Web Page:** [www.gormanrupp.com](http://www.gormanrupp.com)

**Contact:** Taffy DeNavia

**E-mail:** [tdenavia@gormanrupp.com](mailto:tdenavia@gormanrupp.com)

**Products:** Pumps & Packaged Pumping Systems with Controls

**Company Statement of Capabilities:** The Gorman-Rupp Company is a leading manufacturer of self priming, submersible and rotary gear pumps and complete fluid handling systems with a 66 year reputation for innovative technology, excellent production quality and a well trained distribution network serving the needs of global end users. Gorman-Rupp pumps are key elements of fluid systems in the water/wastewater, construction, mining, industrial, agricultural and petroleum market segments. In Latin America Gorman-Rupp has developed an understanding of the needs of the mining sector and has been pleased to service the equipment requirements of mining end users in nearly all countries. In addition to the traditional gold, silver, copper and coal Gorman-Rupp has also been quite active in non-ferrous mining such as nitrates and industrial salts.

**Tytronics, A Metriza Company**

25 Wiggins Avenue

Bedford, Massachusetts 01730-2323 - USA

**Tel:** 800-370-2345, 781-275-9660(ext. 258)

**Fax:** 781-275-9665

**Web Page:** [www.tytronics.com](http://www.tytronics.com)

**Contact:** Dr. Eric F. Mooney

**E-mail:** [efmooney@aol.com](mailto:efmooney@aol.com), [info@tytronics.com](mailto:info@tytronics.com)

**Products:** Process titrators, colorimeters, ISE analyzers and transmission photometers for the UV and visible regions.

**Company Statement of Capabilities:** Tytronics, A Metriza Company, is one of the leading companies with the capability of measuring a whole range of metallic and non-metallic components in wastewater. As well as making process measurements for the process control and optimization of the mining operation.

X ? Cierre  
? Closure

---

## X. Cierre

Antes del cierre de un sitio minero, varios aspectos necesitan ser abordados para asegurar que mínimas alteraciones al ambiente están quedando luego del cierre o que se producirán en el largo plazo. La composición química de las pilas de desperdicios o relaves tiene que ser analizada para determinar el potencial para drenaje ácido y planes tienen que desarrollarse para prevenir el AMD en el largo plazo.

Los caminos de acceso tienen que ser bloqueados y sujetos a reclamación. Los tajos abiertos pueden requerir el manejo del agua de AMD y de las pendientes. Pozas subterráneas requieren bloqueo. Las pilas de roca de desecho, instalaciones de relaves, pozos de lixiviación y caminos deben ser reclamados.

---

## X. Closure

Before closing a mine site, several aspects need to be addressed to ensure that minimal alteration to the environment will be left after closure or will be produced in the long run. Chemical composition of waste stockpiles or tailings has to be analyzed in order to determine the potential for acid drainage and plans developed in order to prevent long term AMD.

Access roads need to be blocked and reclaimed. Open pits may require handling AMD waters and slope. Underground shafts will require blocking. Waste rock piles, tailings facilities, heap leach, and roads should be reclaimed.

### **American Excelsior Company**

850 Avenue H East, P.O. Box 5067  
Arlington, Texas 76005-5067 - USA

**Tel:** 800-777-7645

**Fax:** 817-633-3624

**Web Page:** [www.amerexcel.com](http://www.amerexcel.com)

**Contact:** Steve Walker, Howard Wagner

**E-mail:** [dec\\_esd@hotmail.com](mailto:dec_esd@hotmail.com)

**Products:** Erosion Control Blankets - Curlex, Hydraulic Mulch - Fiber Cel, Sediment Log, Turf Reinforcement Mat (TRM), Articulated Erosion Control System - Tri-Lock.

**Company Statement of Capabilities:** The Earth Science Division of American Excelsior Company is the most experienced producer of erosion control and water management systems in the United States with over 35 years of manufacturing and product applications history. The company established an industry with the introduction of Curlex biodegradable erosion control blanket in 1963. This product has been used successfully in all 50 states and many international locations including Central and South America.

**HY - TRAN, INC.**

P.O. Box 279

Stoughton, Wisconsin 53589-0279 - USA

**Tel:** 608-877-9201

**Fax:** 608-877-9204

**Contact:** Ross Jahn

**E-mail:** hytranmds@aol.com

**Products:** Pump Flotation Systems - Pump Floats, Dirty Water/Slurry Transfer, Dewatering, Floating Pipelines

**Company Statement of Capabilities:** Hy-Tran, Inc. is a supplier of custom designed floating pumping systems as well as portable, land based clean water, dirty water or slurry pumping systems. We can float any style or brand of pump/motor combination, new or used. Underground, open cast and pond dewatering is a specialty using centrifugal slurry pumps. Hydraulic mining eductors and monitors are also designed and supplied. All fabrications are designed for shipping container transport to jobsites.

---

**XI. Reclamación/Revegetación**

El objetivo de la reclamación y la revegetación es restablecer la tierra hacia un uso posterior a la explotación minera y que fue establecido previamente. Las compañías mineras pueden enfocar la reclamación en, al menos, tres diferentes esquemas, dependiendo de la ocasión en la que se efectúa. Así, las actividades de reclamación pueden ser aplicadas continuamente conforme se va explotando la mina o por segmentos conforme sectores específicos de la mina son agotados o al final de las operaciones mineras.

Como parte de las tareas de reclamación, la revegetación brinda una excelente oportunidad para que la tierra sea restaurada y al mismo tiempo se ayude a prevenir futuros problemas con las escorrenterías, la estabilización de la tierra o la contaminación por polvo.

---

**XI. Reclamation/Revegetation**

The objective of reclamation and revegetation activities is to restore the land to a pre-established post-mining land use. Mining companies can approach reclamation in at least three different schemes, depending on the timing in which it is performed. Thus, reclamation activities can be applied on an ongoing basis as the mine is exploited or by segments as specific mine sectors are depleted or at the end of mine operations. As part of reclamation tasks, revegetation provides an excellent opportunity for land to be restored and at the same time helps prevent future water runoff issues, land stabilization, or dust pollution.

XI ? Reclamación/ Revegetación  
? Reclamation/ Revegetation

**American Excelsior Company**

850 Avenue H East, P.O. Box 5067  
Arlington, Texas 76005-5067 - USA

**Tel:** 800-777-7645

**Fax:** 817-633-3624

**Web Page:** www.amerexcel.com

**Contact:** Steve Walker, Howard Wagner

**E-mail:** dec\_esd@hotmail.com

**Products:** Erosion Control Blankets - Curlex, Hydraulic Mulch - Fiber Cel, Sediment Log, Turf Reinforcement Mat (TRM), Articulated Erosion Control System - Tri-Lock.

**Company Statement of Capabilities:** The Earth Science Division of American Excelsior Company is the most experienced producer of erosion control and water management systems in the United States with over 35 years of manufacturing and product applications history. The company established an industry with the introduction of Curlex biodegradable erosion control blanket in 1963. This product has been used successfully in all 50 states and many international locations including Central and South America.

**Georgia Duck & Cordage Mill**

21 Laredo Drive  
Scottdale, Georgia 30079 - USA

**Tel:** 404-294-5272

**Fax:** 404-296-5165

**Web Page:** www.gaduck.com

**Contact:** Jim Hinson

**E-mail:** jim.hinson@gaduck.com

**Products:** Conveyors, Belts, Components.

**Company Statement of Capabilities:** The Georgia Duck & Cordage Mill has been in business since the turn of the century concentrating in heavy duty industrial textile products. For over 40 years, Georgia Duck has been a leading independent supplier of belting carcass and hose cord. Our customers traditionally have been the major producers of conveyor belts and hose. Today, the majority of the output is absorbed by our own belting operations. Georgia Duck has pioneered many of the developments which make possible the high quality constructions found in today's conveyor belting.

**Reinco Inc.**

P.O. Box 512 / 520 North Avenue  
Plainfield, New Jersey 07061-0512 - USA

**Tel:** 908-755-0921, 800-526-7687

**Fax:** 908-755-6379

**Web Page:** www.reinco.com

**Contact:** Goerge F. Braun III

**E-mail:** sales@reinco.com

***(Reinco Inc. cont'd)***

***Products:*** Reclamation Equipment: Hydrograssers, Power Mulchers, Mulch Disc and RMB Tackifier products.

***Company Statement of Capabilities:*** For nearly forty years Reinco has supplied the landscape construction industry with high quality equipment. Early machines were used to manage the recovery of long stretches of highway and utility construction projects. These methods have been applied to offer residential and commercial landscapers, nurseries, golf and athletic field programs, municipal, state and national parks, forestry and mine reclamation, schools and institutions, cemeteries, military installations and others, with a cost-effective and labor-saving alternative to other installation and maintenance practices. With available options and accessories, the equipment can be tailored to your specific application.

**REVEX Revegetation Exchange, Inc.**

8941 Woodland Road  
Longmont, Colorado 80503 - USA

***Tel:*** 303-772-4335

***Fax:*** 303-772-4349

***Web Page:*** [www.revex.com](http://www.revex.com)

***Contact:*** Chuck Austin

***E-mail:*** [chuck@revex.com](mailto:chuck@revex.com)

***Products:*** Reclamation Equipment: Hydroseeders, Straw Mulchers, Krimpers, Seeders, Used Equipment, Erosion Control Products: Tackifiers, Hydraulic Mulch, Soil Amendments, Bonded Fiber Matrix, Organic Blankets, Synthetic Blankets.

***Company Statement of Capabilities:*** Revex, Revegetation Exchange, Inc. is a distributor of erosion control materials and revegetation equipment throughout the world. We also act as consultants on erosion control needs for firms throughout the world. Chuck Austin, have worked on such projects as the Southern California Firestorm Reclamation in 1993, The Bellingham, Washington Fire reclamation in 1999 and many other revegetation and erosion control projects throughout Asia, Europe and South America. We have the capabilities of assisting in developing erosion control plans for all types and sizes of projects and then providing both the expertise and assistance in purchasing the necessary equipment and materials to complete the project.

**S&S Seeds Inc.**

P.O. Box 1275  
Carpinteria, California 93014-1275 - USA

***Tel:*** 805-684-0436

***Fax:*** 805-684-2798

***Web Page:*** [www.ss-seeds.com](http://www.ss-seeds.com)

***Contact:*** Victor W. Schaff

***E-mail:*** [ssseeds@silcom.com](mailto:ssseeds@silcom.com)

***Products:*** Seeds of wildflowers, trees, shrubs, grasses and native plants.

---

## **XII. Consultoría**

---

## **XII. Consulting**

---

### **American Geological Services, Inc.**

3222 S. Vance St., Suite 100  
Lakewood, Colorado 80227 - USA  
**Tel:** 888-748-7488, 303-988-1845  
**Fax:** 303-986-2898  
**Web Page:** www.amer-geo.com  
**Contact:** Mark A. Arnold  
**E-mail:** ags@rmi.net

**Products:** Full Service Environmental, Geological, Natural Resource Consulting Firm, AMD ProMac Distributor.

**Company Statement of Capabilities:** American Geological Services, Inc., (AGS) is a full-service environmental, geological, and natural resource consulting firm which provides quality service for the environmental industry. AGS and its professionals have been actively involved in mining environmental and acid mine drainage (AMD) studies, characterizations, mitigation, reclamation and facilities closure. Our experience is both domestic and international. AGS personnel have direct experience in working with the permitting, operation, monitoring, reclamation and remediation of mining operations. Our experience includes energy, mineral (coal and nuclear), metallic, and industrial mineral mines and processing centers.

### **Applied Ecological Services**

17921 Smith Road  
Broadhead, Wisconsin 53520 - USA  
**Tel:** 608-897-8641  
**Fax:** 608-897-8486  
**Web Page:** www.appliedeco.com  
**Contact:** Jack Broughton, Ron Wade  
**E-mail:** appliedeco@brodnet.com

**Products:** Erosion and Sedimentation Control, Reclamation/Revegetation, Wetlands Creation/Restoration, Ecological Consulting.

**Company Statement of Capabilities:** Applied Ecological Services is a full-service ecological consulting and restoration firm with special expertise in mine reclamation, revegetation of disturbed sites, and stabilization of slopes which benefit from native species revegetation for erosion prevention. Projects benefit from AES's expertise in alternative, ecological-based approaches that often provide greater performance and long-term sustainability. This ecological systems approach requires a strong scientific underpinning to properly recognize and analyze multiple factors that play important, dynamic roles in environmental sites such as mines.

### **Aquatic Eco-Systems, Inc.**

1767 Benbow Court  
Apopka, Florida 32703 - USA  
**Tel:** 407-886-3939  
**Fax:** 407-886-6787

*(Aquatic Eco-Systems, Inc. cont'd)*

**Web Page:** www.aquaticeco.com

**Contact:** Ricardo Arias

**E-mail:** aes@aquaticeco.com

**Products:** Water Treatment.

**Beak International Incorporated**

140 Rotech Drive

Lancaster, New York 14086-9755 - USA

**Tel:** 716-759-11200

**Fax:** 716-759-1489

**Contact:** Pierre Stecko

**E-mail:** pstecko@beak.com

**Products:** Environmental Monitoring and Assessment, Mine Waste Management, Reclamation and Restoration, Process and Environmental Chemistry, Planning and Assessment, Water Management; Technologies: Oxygen Consumption Methods for determining real-time oxidation rates.

**Company Statement of Capabilities:** BEAK International Incorporated offers a full range of impact assessment services for the mining industry. Since 1955, BEAK has provided scientific and technological services for mine development, operation and closure projects world-wide. BEAK's expertise includes: integrated environmental assessment, aquatic ecology and fisheries, aquatic and terrestrial toxicology, hydrology, water quality assessment and modelling, mine drainage, hydrogeochemistry and source term modelling, tailings and waste rock management, hydrogeology, air quality assessment and modelling, environmental risk assessment, risk management and litigation support. Recently, BEAK has provided consulting services to Latin American clients including Minera Antamina S.A. in Peru and Minera Alumbrera Ltda. in Argentina.

**Chester Engineers**

Cherrington Corporate Center, 600 Clubhouse Drive

Moon Township, Pennsylvania 15108 - USA

**Tel:** 800-337-0777, 412-269-5700

**Fax:** 412-269-5749

**Web Page:** www.chester-engineers.com

**Contact:** Robert Zick (Peru Team), Lori Bonham

**E-mail:** ZickR@usfilter.com

**Products:** Engineering: water, wastewater, air quality, geoscience and environmental management (i.e. assessment and remediation), environmental and information systems.

**Company Statement of Capabilities:** Chester Engineers, one of the nation's leading engineering firms in water, wastewater, air quality, geoscience and environmental management, has been providing both industries and municipalities with exceptional solutions for their water and wastewater problems since 1910. Our engineering services range from comprehensive turnkey solutions to targeted, client-specific services. The flexibility of our capabilities and our product diversity allow Chester the ability to provide clients

***(Chester Engineers cont'd)***

with single-source solutions for any problem, small or large. Chester Engineers is part of United States Filter Corporation, the leading global provider of industrial, municipal and residential water and wastewater treatment systems, products and services.

**Clean Gas Systems, Inc.**

160-2 Remington Boulevard  
Ronkonkoma, New York 11779 - USA

**Tel:** 631-467-1600

**Fax:** 631-467-1688

**Web Page:** [www.cgscgs.thomasregister.com](http://www.cgscgs.thomasregister.com)

**Contact:** Anil M. Shah

**E-mail:** [cgscgs@aol.com](mailto:cgscgs@aol.com)

**Products:** Consulting in Air Pollution Control Systems.

**Company Statement of Capabilities:** Design, engineer, manufacture and service air pollution control systems and equipment. Product line includes: single, twin and quad cyclones; centrifugal, dynamic, multi-venturi and conventional scrubbers; gas absorbers for SO<sub>2</sub>, C<sub>12</sub>, HC<sub>1</sub>, H<sub>2</sub>S, HF, NH<sub>3</sub> and odor control; oil mist, fume, smoke and mist collectors; wet electrostatic precipitators; rotary gates; trickle valves and dump gates; complete systems. Decades of total systems experience. Licensee's and representatives throughout the U.S.A., Canada and major countries, worldwide.

**Engineering and Mining Experiment Station, South Dakota School of Mines and Technology**

Mineral Industries Building, Room 234, 501 East Saint Joseph Street  
Rapid City, South Dakota 57701-3995 - USA

**Tel:** 605-394-2496

**Fax:** 605-394-5360

**Web Page:** [www.sdsmt.edu/es/emes/](http://www.sdsmt.edu/es/emes/)

**Contact:** Edward F. Duke

**E-mail:** [eduke@silver.sdsmt.edu](mailto:eduke@silver.sdsmt.edu)

**Products:** Analytical and Technical Services.

**Company Statement of Capabilities:** The Engineering and Mining Experiment Station (EMES) maintains modern geoanalytical laboratories at the South Dakota School of Mines and Technology. Laboratory services are open to government and commercial users as well as to the school's students and faculty. The EMES offers special expertise in the following analytical areas: (1) quantitative X-ray diffraction of rocks, soils, ores, and metals; (2) scanning electron microscopy and microanalysis of rocks and ores; (3) metal fire assay and general elemental analysis; (4) fluid inclusion microthermometry; (5) laboratory and field visible and near infrared reflectance spectroscopy; and (6) remote sensing analysis and image processing.

**Golder Associates Brazil, Ltda.**

Rue Goncalves Dias 3172, 3 Andar  
Santo Agostinho, Belo Horizonte, Brazil

**Tel:** 55-31-275-2417

**Fax:** 55-31-291-9649

**Contact:** Roy F. Lopes

**Products:** Full service consulting, permitting and regulatory support, strategic planning and mining risk management, environmental audits and risk assessment, environmental assessments (property transfer and compliance), community relations and public involvement, AMD, Engineering, environmental, geotechnical, hydrology.

**Golder Associates Peru S.A.**

Calle 22 N° 215, Urb. Corpac  
San Borja, Lima 41, Peru

**Tel:** 51-1-224-9362

**Fax:** 51-1-475-2150

**Contact:** Siegfried Arce H.

**Products:** Full service consulting, permitting and regulatory support, strategic planning and mining risk management, environmental audits and risk assessment, environmental assessments (property transfer and compliance), community relations and public involvement, AMD, Engineering, environmental, geotechnical, hydrology.

**Golder Associates S.A.**

Fidel Oteiza 1921, Of. 906  
Providencia, Santiago, Chile

**Tel:** 56-2-366-9375

**Fax:** 56-2-366-9372

**Contact:** Chris Beggs

**Products:** Full service consulting, permitting and regulatory support, strategic planning and mining risk management, environmental audits and risk assessment, environmental assessments (property transfer and compliance), community relations and public involvement, AMD, Engineering, environmental, geotechnical, hydrology.

**Golder Associates, Inc.**

200 Union Boulevard  
Lakewood, Colorado 80228 - USA

**Tel:** 303-980-0540

**Fax:** 303-985-2080

**Web Page:** [www.golder.com](http://www.golder.com)

**Contact:** Pamela Stella

**E-mail:** [pstella@golder.com](mailto:pstella@golder.com)

**Products:** Full service consulting, permitting and regulatory support, strategic planning and mining risk management, environmental audits and risk assessment, environmental assessments (property transfer and compliance), community relations and public involvement, AMD, Engineering, environmental, geotechnical, hydrology.

**(Golder Associates, Inc. cont'd)**

**Company Statement of Capabilities:** Golder Associates Corporation (Golder) is an international group of employee-owned consulting engineering and environmental companies specializing in the application of earth sciences and engineering to environmental, natural resources and civil works projects. Operating since 1960, the company is staffed by more than 1,900 personnel and maintains a network of more than 80 offices worldwide (United States, Canada, Australia, Asia, Europe). Our Latin America offices are located in Peru, Chile, Argentina, Ecuador, Brazil, and Colombia. Golder has project experience in more than 130 countries. Our engineers and scientists provide a wide variety of expertise including geotechnical and civil engineering design; environmental management and planning; water resources management and hydrology; construction management and quality control, and risk assessment and management.

**Hydrometrics, Inc.**

2727 Airport Road

Helena, Montana 59601 - USA

**Tel:** 406-443-4150

**Fax:** 406-443-4155

**Web Page:** [www.hydrometrics.com](http://www.hydrometrics.com)

**Contact:** Steve W. Ackerlund

**E-mail:** [wackerlund@hydrometrics.com](mailto:wackerlund@hydrometrics.com)

**Products:** Scientists, engineers and contractors: runoff control, water and wastewater treatment, remediation, solid waste handling, water supply and distribution, facility closure and compliance.

**Company Statement of Capabilities:** Hydrometrics' mission is to provide cost-effective and practical scientific, engineering and construction services for industrial, commercial and municipal sectors in the United States and select foreign markets (principally Mexico and Peru). Major service areas include: mine permitting and closure, environmental work at smelters and refineries, water treatment design, construction management, and remedial construction. Hydrometrics has developed several water treatment technologies with specific application to mining. The Anoxic Biotreatment Cell (ABC) has proven cost-effective at removing nitrates, selenium and sulfates at mines. The Cost-Effective Sulfate Removal (CESR) process work in conjunction with lime precipitation to treat sulfate to below standards.

**Knight Piesold Consultores S.A.**

Los Tucanes 136-142, San isidro

Lima-27, Peru

**Tel:** 51-1-422-0844

**Fax:** 51-1-422-0331

**Contact:** Mario Villavisencio

**E-mail:** [mvillavi@kplima.com.pe](mailto:mvillavi@kplima.com.pe)

**Products:** Full service consulting company: AMD, engineering, environmental, geotechnical, geographic information systems, hydrological.

*(Knight Piesold Consultores S.A. cont'd)*

**Company Statement of Capabilities:** Established in 1921, Knight Piesold is a consultancy group committed to the provision of engineering, environmental and economics services of the highest caliber to an extensive world-wide client base. Knight Piesold provides a comprehensive range of services for all aspects of project development from inception through implementation to the post-commissioning stage. Expertise is provided to a broad range of sectors, with particular emphasis on: mining, environment, water resources and supply, hydropower, thermal power and heavy structures, roads and transportation.

**Knight Piesold Consultores S.A.**

1050 Seventeenth Street, Suite 500

Denver, Colorado 80265 - USA

**Tel:** 303-629-8788

**Contact:** Barbara Filas

**E-mail:** barb@kpc.com

**Products:** Full service consulting company: AMD, engineering, environmental, geotechnical, geographic information systems, hydrological.

**Company Statement of Capabilities:** Established in 1921, Knight Piesold is a consultancy group committed to the provision of engineering, environmental and economics services of the highest caliber to an extensive world-wide client base. Knight Piesold provides a comprehensive range of services for all aspects of project development from inception through implementation to the post-commissioning stage. Expertise is provided to a broad range of sectors, with particular emphasis on: mining, environment, water resources and supply, hydropower, thermal power and heavy structures, roads and transportation.

**McVehil-Monnett Associates, Inc.**

44 Inverness Drive East, Bldg. C

Englewood, Colorado 80112 - USA

**Tel:** 303-790-1332

**Fax:** 303-790-7820

**Web Page:** www.mcvehil-monnett.com

**Contact:** William Monnett

**E-mail:** mcv-mon@ix.netcom.com

**Products:** Consultants, air quality permitting, modeling, monitoring and impact assessment.

**Company Statement of Capabilities:** Founded in 1984, McVehil-Monnett Associates, Inc. (MMA) is a specialized consulting firm of atmospheric scientist and air quality engineers providing permitting, compliance, modeling, monitoring and impact assessment services to a broad range of mining clients worldwide. MMA's Latin America mining experience includes work in Peru, Argentina, Chile, Bolivia, El Salvador and Panama. Our professional staff averages over 16 years of experience, with two-thirds having advanced degrees and/or professional certifications. With this high level of knowledge and experience MMA offers a proven ability to solve air quality problems and expedite permitting and monitoring processes.

XII ? Consultoria  
? Consulting

**Mine Engineers, Inc.**

P.O. Box 3026

Cheyenne, Wyoming 82003 - USA

**Tel:** 307-638-8833

**Fax:** 307-638-0578

**Web Page:** www.mine-engineers.com

**Contact:** Eldon Strid

**E-mail:** mail@mine-engineers.com

**Products:** Satellite imagery and engineering services.

**Company Statement of Capabilities:** Environmental and mining engineering services for the mining industry. Distributors of satellite imagery.

**Mines Group, The**

1325 Airmotive Way, Suite 175U

Reno, Nevada 89502 - USA

**Tel:** 775-322-7622

**Fax:** 775-322-2660

**Contact:** Anthony E.W. Crews, PE or Kenneth Myers, PE

**E-mail:** minesgrp@aol.com

**Products:** Mining, geotechnical, civil and environmental.

**Company Statement of Capabilities:** The MINES Group, Inc. is a professional organization dedicated to the technical advancement of the mining industry and providing responsive consulting services to meet the needs of individual clients. The MINES Group, Inc. was formed with the intent of providing a high level of principal involvement in projects and providing professional staff with hands on experience within the particular field of expertise required to complete the project in a cost-effective manner and within the project schedules. The professional staff have upwards of 12 years experience, with the principals having in excess of 25 years of mining-related experience.

**Pipeline Systems Incorporated (PSI)**

460 North Wiget Lane

Walnut Creek, California 94598-2408 - USA

**Tel:** 925-974-7272

**Fax:** 925-937-8875

**Web Page:** www.pipesys.com

**Contact:** Steve Young

**E-mail:** syoung@pipesys.com

**Products:** Pipeline engineering: design of pipeline systems to transport mineral concentrates, coal, water and tailings.

**Company Statement of Capabilities:** Pipeline Systems Incorporated (PSI) is a medium-sized, multi-disciplinary engineering firm servicing the international mining industry from Walnut Creek, California. Formed in 1979, PSI is recognized as the world leader specializing in the design of long distance pipeline systems for the transport of mineral concentrates, coal, industrial minerals, water and tailings. Personnel from PSI have

participated in the engineering of the majority of all slurry transportation systems installed in the past three decades. PSI specializes in services for pipeline transportation system development from testing in PSI's laboratory, due diligence studies, feasibility studies, basic engineering, detailed engineering, construction support, system start-up, commissioning and operator training.

**SEMSI (Swanson Environmental Management Systems, Inc.)**

9085 South Bear Mountain Drive  
Highlands Ranch, Colorado 80126 - USA

**Tel:** 303-471-8665

**Fax:** 303-471-0445

**Web Page:** In construction

**Contact:** David Swanson, Alicia Williamson

**E-mail:** semsi@ix.netcom.com

**Products:** Environmental Management System (EMS) services, pollution prevention/cleaner production technical assistance, ISO 14001 services, environmental technologies.

**Company Statement of Capabilities:** SEMSI is an international, environmental consulting firm specializing in providing customized Environmental Management System (EMS) services that incorporate pollution prevention practices and clean technology solutions to industry, government, and non-government organizations. SEMSI utilizes its "hands-on" pollution prevention/clean technology expertise and know-how to search and find the best, innovative, proven environmental technology(ies) to meet a client's environmental need. David W. Swanson, president and founder of SEMSI, has worked with over 300 businesses and manufacturers, both domestically and internationally, to develop and incorporate cleaner production oriented EMS programs. Often his proactive EMS programs had a payback period of less than two years.

**Shepherd Miller, Inc.**

3801 Automation Way, Suite 100  
Fort Collins, Colorado 80525 - USA

**Tel:** 970-223-9600

**Fax:** 970-223-7171

**Web Page:** www.shepmill.com

**Contact:** Thomas A. Shepherd; John Chermak

**E-mail:** tshepherd@shepmill.com; jchermak@shepmill.com

**Products:** Environmental and Engineering

**Company Statement of Capabilities:** Shepherd Miller, Inc. specializes in providing environmental engineering and science services to the mining industry. Shepherd Miller has been in business since 1990 solving environmental problems at mine sites in North America, South America, and Asia. Our areas of expertise include the following: design of acid mine drainage mitigation alternatives; geotechnical design of mine facilities; design of cover systems; remedial investigations and feasibility studies; prediction and analysis of surface and groundwater impacts; revegetation plans; regulatory and permitting support; site characterization and baseline studies; site closure planning; environmental audits; and human and ecological risk assessment.

XII ? Consultoria  
? Consulting

**The John T. Boyd Company**

Four Gateway Center, Suite 1900, 444 Liberty Avenue  
Pittsburgh, Pennsylvania 15222-1212 - USA

**Tel:** 412-562-1770

**Fax:** 412-562-1953

**Web Page:** [www.jtboyd.com](http://www.jtboyd.com)

**Contact:** George Stepanovich Jr.

**E-mail:** [gs@jtboyd.com](mailto:gs@jtboyd.com)

**Products:** Mining and geological consulting.

**Company Statement of Capabilities:** The John T. Boyd Company has the technical capability and experience to provide economic solutions to maintain compliance and avoid exposure to environmental risks relating to the mining industry. Our environmental services include: Mine closure and reclamation liability studies, due diligence assessments, mine reclamation plans, mine drainage studies, hydrologic investigations, water resource inventories, refuse disposal and waste management planning, subsidence and control.

**Western States Mining Consultants, P.C.**

770 W. Collins, Suite 200

Casper, Wyoming 82601 - USA

**Tel:** 307-266-9117

**Fax:** 307-265-7086

**Web Page:** [www.westernstatesmining.com](http://www.westernstatesmining.com)

**Contact:** David H. Scriven, P.E.

**E-mail:** [wsmc@coffey.com](mailto:wsmc@coffey.com)

**Products:** Mining, environmental, geological and geotechnical engineering.

**Company Statement of Capabilities:** Engineering company with diversified experience in all phases of permitting, mining and reclamation. Specialize in permitting, rock mechanics and geotechnical engineering, solid waste disposal (tailings), economic evaluations and due diligence reporting.

## Index of Company Names and Contact Information

### **Advanced Drainage Systems, Inc**

3300 Riverside Drive  
Columbus, Ohio 43221 - USA  
**Tel:** 614-457-3051  
**Fax:** 614-538-5825  
**Web Page:** [www.ads-pipe.com](http://www.ads-pipe.com)  
**Contact:** John Adams  
**E-mail:** [jadams@infinet.com](mailto:jadams@infinet.com)

### **American Excelsior Company**

850 Avenue H East, P.O. Box 5067  
Arlington, Texas 76005-5067 - USA  
**Tel:** 800-777-7645  
**Fax:** 817-633-3624  
**Web Page:** [www.amerexcel.com](http://www.amerexcel.com)  
**Contact:** Steve Walker, Howard Wagner  
**E-mail:** [dec\\_esd@hotmail.com](mailto:dec_esd@hotmail.com)

### **American Geological Services, Inc.**

3222 S. Vance St., Suite 100  
Lakewood, Colorado 80227 - USA  
**Tel:** 888-748-7488, 303-988-1845  
**Fax:** 303-986-2898  
**Web Page:** [www.amer-geo.com](http://www.amer-geo.com)  
**Contact:** Mark A. Arnold  
**E-mail:** [ags@rmi.net](mailto:ags@rmi.net)

### **Amoco Fabrics & Fiber Company**

260 The Bluffs  
Austell, Georgia 30168 - USA  
**Tel:** 770-944-4569  
**Fax:** 770-944-4584  
**Web Page:** [www.geotextiles@amoco.com](http://www.geotextiles@amoco.com)  
**Contact:** Jose Roberto Montalvo  
**E-mail:** [geotextiles@amoco.com](mailto:geotextiles@amoco.com)

### **Applied Ecological Services**

17921 Smith Road  
Broadhead, Wisconsin 53520 - USA  
**Tel:** 608-897-8641  
**Fax:** 608-897-8486  
**Web Page:** [www.appliedeco.com](http://www.appliedeco.com)  
**Contact:** Jack Broughton, Ron Wade  
**E-mail:** [appliedeco@brodnet.com](mailto:appliedeco@brodnet.com)

**Applied Surface Technologies AST Coatings Applied**

1423 West Ormsby Avenue  
Louisville, Kentucky 40210 - USA

**Tel:** 502-634-9458

**Fax:** 502-634-1130

**Web Page:** [www.astl.com](http://www.astl.com)

**Contact:** Dave McEwan

**E-mail:** [tech@astl.com](mailto:tech@astl.com)

**Aquatic Eco-Systems, Inc.**

1767 Benbow Court  
Apopka, Florida 32703 - USA

**Tel:** 407-886-3939

**Fax:** 407-886-6787

**Web Page:** [www.aquaticeco.com](http://www.aquaticeco.com)

**Contact:** Ricardo Arias

**E-mail:** [aes@aquaticeco.com](mailto:aes@aquaticeco.com)

**Arizona Instrument Corp.**

4114 E. Wood Street  
Phoenix, Arizona 85040 - USA

**Tel:** 800-528-7411, 602-470-1414

**Fax:** 602-470-1888

**Web Page:** [www.azic.com](http://www.azic.com)

**Contact:** Terri Thomas

**E-mail:** [tthomas@azic.com](mailto:tthomas@azic.com)

**Armortec**

2853 Meadow Hill Drive, North  
Clearwater, Florida 33761 - USA

**Tel:** 727-726-5790

**Fax:** 727-724-1955

**Web Page:** [www.armortec.com](http://www.armortec.com)

**Contact:** Robert Mohler

**E-mail:** [bscres@earthlink.net](mailto:bscres@earthlink.net)

**Athey Products Corporation**

1839 South Main Street  
Wake Forest, North Carolina 27587 - USA

**Tel:** 919-556-5171

**Fax:** 919-556-0122

**Web Page:** [www.athey.com](http://www.athey.com)

**Contact:** N. Anthony Wakim

**E-mail:** [nawakim@athey.com](mailto:nawakim@athey.com)

**Baker Process, division of Baker Hughes Inc.**

669 West 200 South Street P.O. Box 300

Salt Lake City, Utah 84110 - USA

*Tel:* 801-526-2909

*Fax:* 801-526-2923

*Contact:* Frank Baczek

*E-mail:* Frank.Baczek@bakerhughes.com

**Beak International Incorporated**

140 Rotech Drive

Lancaster, New York 14086-9755 - USA

*Tel:* 716-759-11200

*Fax:* 716-759-1489

*Contact:* Pierre Stecko

*E-mail:* pstecko@beak.com

**Belt Maintenance Group**

240 Seneca Street

Buffalo, New York 14204 - USA

*Tel:* 716-852-0832

*Fax:* 716-852-4198

*Web Page:* [www.beltmaintenance.com](http://www.beltmaintenance.com)

*Contact:* Ron Fernandes, David Miller

*E-mail:* ronfernandes@worldnet.att.net; davemillerbmg@worldnet.att.net

**Ceilcote Air Pollution Control**

14955 Sprague Rd., Ste 250

Strongsville, Ohio 44136-1758 - USA

*Tel:* 440-243-0700

*Fax:* 440-243-9854

*Web Page:* [www.ceilcoteapc.com](http://www.ceilcoteapc.com)

*Contact:* Barbara Cicigoi

*E-mail:* sales@ceilcoteapc.com

**CertainTeed Products Group**

750 Swedesford Road, P.O. Box 860

Valley Forge, Pennsylvania 19482 - USA

*Tel:* 610-341-7000

*Fax:* 610-341-6837

*Contact:* Ken McHugh

**Chester Engineers**

Cherrington Corporate Center, 600 Clubhouse Drive

Moon Township, Pennsylvania 15108 - USA

**Tel:** 800-337-0777, 412-269-5700

**Fax:** 412-269-5749

**Web Page:** [www.chester-engineers.com](http://www.chester-engineers.com)

**Contact:** Robert Zick (Peru Team), Lori Bonham

**E-mail:** [ZickR@usfilter.com](mailto:ZickR@usfilter.com)

**Clean Gas Systems, Inc.**

160-2 Remington Boulevard

Ronkonkoma, New York 11779 - USA

**Tel:** 631-467-1600

**Fax:** 631-467-1688

**Web Page:** [www.cgscgs.thomasregister.com](http://www.cgscgs.thomasregister.com)

**Contact:** Anil M. Shah

**E-mail:** [cgscgs@aol.com](mailto:cgscgs@aol.com)

**Coeur d'Alene Mines Corporation**

505 Front Avenue, P.O. Box 1

Coeur D'Alene, Idaho 83816-0316 - USA

**Tel:** 208-667-3511

**Fax:** 208-667-2213

**Web Page:** [www.coeur.com](http://www.coeur.com)

**Contact:** Luke Russell

**E-mail:** [lrussell@coeur.com](mailto:lrussell@coeur.com)

**Continental Conveyor & Equipment Company**

P.O. Box 400

Winfield, Alabama 35594 - USA

**Tel:** 205-487-6492

**Fax:** 205-487-4233

**Web Page:** [www.continentalconveyor.com](http://www.continentalconveyor.com)

**Contact:** Greg Chaffin

**E-mail:** [info@continentalconveyor.com](mailto:info@continentalconveyor.com)

**Creative Engineering Company**

3513 Century Drive

Bakersfield, California 93306-1238 - USA

**Tel:** 661-872-4763

**Fax:** 661-871-1798

**Web Page:** [www.suverkrop.com](http://www.suverkrop.com)

**Contact:** Don Suverkrop

**D.R. Technology, Inc.**

73 South Street  
Freehold, New Jersey 07728 - USA  
**Tel:** 732-780-4664  
**Fax:** 732-780-1545  
**Contact:** Richard Schwartz  
**E-mail:** drtchnj@aol.com

**Dust Solutions Incorporated**

PMB # 434, 11919 N. Jantzen Ave.  
Portland, Oregon 97217 - USA  
**Tel:** 360-546-0072  
**Fax:** 360-546-0073  
**Web Page:** www.nodust.com  
**Contact:** David Gilroy  
**E-mail:** adswest@pacifier.com

**Engineering and Mining Experiment Station, South Dakota School of Mines and Technology**

Mineral Industries Building, Room 234, 501 East Saint Joseph Street  
Rapid City, South Dakota 57701-3995 - USA  
**Tel:** 605-394-2496  
**Fax:** 605-394-5360  
**Web Page:** www.sdsmt.edu/es/emes/  
**Contact:** Edward F. Duke  
**E-mail:** eduke@silver.sdsmt.edu

**Entek IRD International Corporation**

1700 Edison Drive  
Milford, Ohio 45150 - USA  
**Tel:** 513-576-6151 (US) / 51-1-222-0064 (Peru)  
**Fax:** 513-5766104 (US) / 51-1-421-0302 (Peru)  
**Web Page:** www.entekird.com  
**Contact:** Rick W. Carlisle (US) / Augusto de la Piedra (Peru)  
**E-mail:** rcarlisle@entekird.com (US) / postmast@iisaap.com.pe (Peru)

**Environmental Chemistries, Inc.**

753 West 1760 South  
Salt Lake City, Utah 84104 - USA  
**Tel:** 800-974-0459, 801-974-5080  
**Fax:** 801-974-0459  
**Web Page:** www.infomine.com/index/suppliers/Environmental\_Chemistires,\_Inc.html  
**Contact:** M.S. Burrow

**Fluid Systems (FSI)**

1245 Corporate Blvd. Suite 300  
Aurora, Illinois 60504 - USA  
**Tel:** 800-346-9107, 630-898-1161  
**Fax:** 630-898-1179  
**Web Page:** [www.fluidsystems.com](http://www.fluidsystems.com)  
**Contact:** Linda Englander  
**E-mail:** [fsi@fluidsystems.com](mailto:fsi@fluidsystems.com)

**Georgia Duck & Cordage Mill**

21 Laredo Drive  
Scottdale, Georgia 30079 - USA  
**Tel:** 404-294-5272  
**Fax:** 404-296-5165  
**Web Page:** [www.gaduck.com](http://www.gaduck.com)  
**Contact:** Jim Hinson  
**E-mail:** [jim.hinson@gaduck.com](mailto:jim.hinson@gaduck.com)

**Geosonics Inc./Vibra-Tech**

P.O. Box 779  
Warendale, Pennsylvania 15095 - USA  
**Tel:** 724-934-2900  
**Fax:** 724-934-2999  
**Web Page:** [www.geosonics.com](http://www.geosonics.com)  
**Contact:** Phil Berger  
**E-mail:** [geosonic@iglou.com](mailto:geosonic@iglou.com)

**GeoTDR, Inc.**

297 Pinewood Drive  
Apple Valley, Minnesota 55124 - USA  
**Tel:** 612-431-3415  
**Fax:** 612-892-0241  
**Web Page:** [www.geotdr.com](http://www.geotdr.com)  
**Contact:** Kevin O'Connor  
**E-mail:** [kevin@geotdr.com](mailto:kevin@geotdr.com)

**Golder Associates Brazil, Ltda.**

Rue Goncalves Dias 3172, 3 Andar  
Santo Agostinho, Belo Horizonte, Brazil  
**Tel:** 55-31-275-2417  
**Fax:** 55-31-291-9649  
**Contact:** Roy F. Lopes

**Golder Associates Peru S.A.**

Calle 22 N° 215, Urb. Corpac

San Borja, Lima 41, Peru

*Tel:* 51-1-224-9362

*Fax:* 51-1-475-2150

*Contact:* Siegfried Arce H.

**Golder Associates S.A.**

Fidel Oteiza 1921, Of. 906

Providencia, Santiago, Chile

*Tel:* 56-2-366-9375

*Fax:* 56-2-366-9372

*Contact:* Chris Beggs

**Golder Associates, Inc.**

200 Union Boulevard

Lakewood, Colorado 80228 - USA

*Tel:* 303-980-0540

*Fax:* 303-985-2080

*Web Page:* [www.golder.com](http://www.golder.com)

*Contact:* Pamela Stella

*E-mail:* [pstella@golder.com](mailto:pstella@golder.com)

**Great Western Chemical Company**

808 S.W. 15th Avenue

Portland, Oregon 97205 - USA

*Tel:* 503-228-2600, 800-547-1400

*Fax:* 503-221-5752

*Web Page:* [www.gwchem.com](http://www.gwchem.com)

*Contact:* Taras Warvariv

*E-mail:* [taraswarvariv@gwchem.com](mailto:taraswarvariv@gwchem.com)

**GSE Lining Technology, Inc.**

19103 Gundle Road

Houston, Texas 77073 - USA

*Tel:* 800-435-2008, 281-443-8564

*Fax:* 281-875-6010

*Web Page:* [www.gseworld.com](http://www.gseworld.com)

*Contact:* Mike Mathieson, Mark Harris

*E-mail:* [marketing@gseworld.com](mailto:marketing@gseworld.com)

**Hercules Sealcoat MFG., Inc.**

6596 New Peachtree Road  
Atlanta, Georgia 30340 - USA  
**Tel:** 800-815-7668, 770-455-6551  
**Fax:** 770-455-6531  
**Contact:** Robin Hotle  
**E-mail:** rhotle@aol.com

**HY - TRAN, INC.**

P.O. Box 279  
Stoughton, Wisconsin 53589-0279 - USA  
**Tel:** 608-877-9201  
**Fax:** 608-877-9204  
**Contact:** Ross Jahn  
**E-mail:** hytranmds@aol.com

**Hydrometrics, Inc.**

2727 Airport Road  
Helena, Montana 59601 - USA  
**Tel:** 406-443-4150  
**Fax:** 406-443-4155  
**Web Page:** [www.hydrometrics.com](http://www.hydrometrics.com)  
**Contact:** Steve W. Ackerlund  
**E-mail:** wackerlund@hydrometrics.com

**Inland Technology Incorporated**

401 East 27th Street  
Tacoma, Washington 98421 - USA  
**Tel:** 800-552-3100, 253-383-1177  
**Fax:** 253-593-8749  
**Web Page:** [www.inlandtech.com](http://www.inlandtech.com)  
**Contact:** Eric Lethe  
**E-mail:** inland@inlandtech.com

**Klean Earth Environmental Company (KEECO)**

19023 36th Avenue West, Suite E  
Lynnwood, Washington 98036 - USA  
**Tel:** 425-778-7165  
**Fax:** 425-778-7564  
**Web Page:** [www.keeco.com](http://www.keeco.com)  
**Contact:** Jim Rybock  
**E-mail:** info@keeco.com

**Knight Piesold Consultores S.A.**

Los Tucanes 136-142, San isidro  
Lima-27, Peru

**Tel:** 51-1-422-0844

**Fax:** 51-1-422-0331

**Contact:** Mario Villavisencio

**E-mail:** mvillavi@kplima.com.pe

**Knight Piesold Consultores S.A.**

1050 Seventeenth Street, Suite 500  
Denver, Colorado 80265 - USA

**Tel:** 303-629-8788

**Fax:**

**Contact:** Barbara Filas

**E-mail:** barb@kpco.com

**KPA International - Enviro Green International**

15912 73rd Avenue, S.E.

Snohomish, Washington 98296 - USA

**Tel:** 425-485-6091; 360-668-7344

**Fax:** 425-485-7999

**Web Page:** [www.kpa-envirogreen.com](http://www.kpa-envirogreen.com)

**Contact:** Frank Porembski

**E-mail:** kpafrank@gte.net

**McVehil-Monnett Associates, Inc.**

44 Inverness Drive East, Bldg. C

Englewood, Colorado 80112 - USA

**Tel:** 303-790-1332

**Fax:** 303-790-7820

**Web Page:** [www.mcvehil-monnett.com](http://www.mcvehil-monnett.com)

**Contact:** William Monnett

**E-mail:** mcv-mon@ix.netcom.com

**Midwest Industrial Supply, Inc.**

P.O. Box 8431

Canton, Ohio 44711 - USA

**Tel:** 800-321-0699, 330-456-3121

**Fax:** 330-456-3247

**Web Page:** [www.midwestind.com](http://www.midwestind.com)

**Contact:** William Melis

**E-mail:** billm@midwestind.com

**Mine Engineers, Inc.**

P.O. Box 3026

Cheyenne, Wyoming 82003 - USA

**Tel:** 307-638-8833

**Fax:** 307-638-0578

**Web Page:** [www.mine-engineers.com](http://www.mine-engineers.com)

**Contact:** Eldon Strid

**E-mail:** [mail@mine-engineers.com](mailto:mail@mine-engineers.com)

**Mines Group, The**

1325 Airmotive Way, Suite 175U

Reno, Nevada 89502 - USA

**Tel:** 775-322-7622

**Fax:** 775-322-2660

**Contact:** Anthony E.W. Crews, PE or Kenneth Myers, PE

**E-mail:** [minesgrp@aol.com](mailto:minesgrp@aol.com)

**National Filter Media Corporation**

8895 Deerfield Drive

Olive Branch, Mississippi 38654 - USA

**Tel:** 800-826-6250, 601-895-4660

**Fax:** 601-895-4968

**Contact:** J.A. Anglin

**North American Green, Inc**

14649 Highway 41 North

Evansville, Indiana 47711 - USA

**Tel:** 812-867-6632, 800-772-2040

**Fax:** 812-867-0247

**Web Page:** [www.nagreen.com](http://www.nagreen.com)

**Contact:** Greg Deegan

**E-mail:** [gdeegan@nagreen.com](mailto:gdeegan@nagreen.com)

**Pintail Systems. Inc**

11801 East 33rd Avenue, Suite C

Aurora, Colorado 80010 - USA

**Tel:** 303-367-8443

**Fax:** 303-364-2120

**Contact:** Leslie C. Thompson; Dawn V. Harimon

**E-mail:** [Pintailx@aol.com](mailto:Pintailx@aol.com)

**Pipeline Systems Incorporated (PSI)**

460 North Wiget Lane  
Walnut Creek, California 94598-2408 - USA  
*Tel:* 925-974-7272  
*Fax:* 925-937-8875  
*Web Page:* [www.pipesys.com](http://www.pipesys.com)  
*Contact:* Steve Young  
*E-mail:* [syoung@pipesys.com](mailto:syoung@pipesys.com)

**Quinn Process Equipment Co.**

3400 Brighton Boulevard  
Denver, Colorado 80216 - USA  
*Tel:* 303-295-2872  
*Fax:* 303-295-2706  
*Web Page:* [www.quinnprocess.com](http://www.quinnprocess.com)  
*Contact:* Richard Quinn  
*E-mail:* [quinnproc@aol.com](mailto:quinnproc@aol.com)

**Reinco Inc.**

P.O. Box 512 / 520 North Avenue  
Plainfield, New Jersey 07061-0512 - USA  
*Tel:* 908-755-0921, 800-526-7687  
*Fax:* 908-755-6379  
*Web Page:* [www.reinco.com](http://www.reinco.com)  
*Contact:* Goerge F. Braun III  
*E-mail:* [sales@reinco.com](mailto:sales@reinco.com)

**REVEX Revegetation Exchange, Inc.**

8941 Woodland Road  
Longmont, Colorado 80503 - USA  
*Tel:* 303-772-4335  
*Fax:* 303-772-4349  
*Web Page:* [www.revex.com](http://www.revex.com)  
*Contact:* Chuck Austin  
*E-mail:* [chuck@revex.com](mailto:chuck@revex.com)

**Rocky Mountain Remediation Service, L.L.C.**

1819 Denver West Drive, Building 26, Suite 100  
Golden, Colorado 80401 - USA  
*Tel:* 303-215-6620  
*Fax:* 303-215-6720  
*Web Page:* [www.ebond-ebric.com/ebtechlinks.html](http://www.ebond-ebric.com/ebtechlinks.html)  
*Contact:* Jim Barthel  
*E-mail:* [jbarthel@rmrshq.com](mailto:jbarthel@rmrshq.com)

**S&S Seeds Inc.**

P.O. Box 1275  
Carpinteria, California 93014-1275 - USA  
**Tel:** 805-684-0436  
**Fax:** 805-684-2798  
**Web Page:** [www.ss-seeds.com](http://www.ss-seeds.com)  
**Contact:** Victor W. Schaff  
**E-mail:** [ssseeds@silcom.com](mailto:ssseeds@silcom.com)

**SEMSI (Swanson Environmental Management Systems, Inc.)**

9085 South Bear Mountain Drive  
Highlands Ranch, Colorado 80126 - USA  
**Tel:** 303-471-8665  
**Fax:** 303-471-0445  
**Web Page:** In construction  
**Contact:** David Swanson, Alicia Williamson  
**E-mail:** [semsi@ix.netcom.com](mailto:semsi@ix.netcom.com)

**Shepherd Miller, Inc.**

3801 Automation Way, Suite 100  
Fort Collins, Colorado 80525 - USA  
**Tel:** 970-223-9600  
**Fax:** 970-223-7171  
**Web Page:** [www.shepmill.com](http://www.shepmill.com)  
**Contact:** Thomas A. Shepherd; John Chermak  
**E-mail:** [tshepherd@shepmill.com](mailto:tshepherd@shepmill.com); [jchermak@shepmill.com](mailto:jchermak@shepmill.com)

**Sioux Rubber Applicators, Inc.**

2620 Hawkeye Drive  
Sioux City, Iowa 51105 - USA  
**Tel:** 800-443-9469, 712-252-3257  
**Fax:** 712-252-3258  
**Web Page:** [www.infomine.com/index/suppliers/Sious\\_Rubber\\_Applicators,\\_Inc.html](http://www.infomine.com/index/suppliers/Sious_Rubber_Applicators,_Inc.html)  
**Contact:** Jon Wren  
**E-mail:** [soorubr@aol.com](mailto:soorubr@aol.com)

**Smith Fiberglass Products Company**

2700 W. 65th Street  
Little Rock, Arkansas 72209 - USA  
**Tel:** 501-568-4010  
**Fax:** 501-568-4465  
**Web Page:** [www.smithfiberglass.com](http://www.smithfiberglass.com)  
**Contact:** Susan B. Jones  
**E-mail:** [sjones@aosmith.com](mailto:sjones@aosmith.com)

**The Gorman-Rupp Company**

305 Bowman Street, P.O. Box 1217  
Mansfield, Ohio 44901-1217 - USA  
*Tel:* 419-755-1011, 419-755-1350, 419-755-1352  
*Fax:* 419-755-1266  
*Web Page:* [www.gormanrupp.com](http://www.gormanrupp.com)  
*Contact:* Taffy DeNavia  
*E-mail:* [tdenavia@gormanrupp.com](mailto:tdenavia@gormanrupp.com)

**The John T. Boyd Company**

Four Gateway Center, Suite 1900, 444 Liberty Avenue  
Pittsburgh, Pennsylvania 15222-1212 - USA  
*Tel:* 412-562-1770  
*Fax:* 412-562-1953  
*Web Page:* [www.jtboyd.com](http://www.jtboyd.com)  
*Contact:* George Stepanovich Jr.  
*E-mail:* [gs@jtboyd.com](mailto:gs@jtboyd.com)

**Tramfloc, Inc.**

P.O. Box 350  
Tempe, Arizona 85280-0350 - USA  
*Tel:* 800-613-6803, 480-491-6895  
*Fax:* 480-456-1664  
*Web Page:* [www.tramfloc.com](http://www.tramfloc.com)  
*Contact:* James Franklin  
*E-mail:* [water@tramfloc.com](mailto:water@tramfloc.com)

**Tytronics, A Metrisa Company**

25 Wiggins Avenue  
Bedford, Massachusetts 01730-2323 - USA  
*Tel:* 800-370-2345, 781-275-9660(ext. 258)  
*Fax:* 781-275-9665  
*Web Page:* [www.tytronics.com](http://www.tytronics.com)  
*Contact:* Dr. Eric F. Mooney  
*E-mail:* [efmooney@aol.com](mailto:efmooney@aol.com), [info@tytronics.com](mailto:info@tytronics.com)

**Warman International Chile SA**

Avda. Américo Vespucio # 2512  
Conchalí, Santiago, Chile  
*Tel:* 2-624-1820  
*Fax:* 2-624-1812  
*Web Page:* [www.warmanintl.com](http://www.warmanintl.com)  
*Contact:*  
*E-mail:* [generalinfo@warmanintl.com](mailto:generalinfo@warmanintl.com)

**Warman International, Inc.**

2701 South Stoughton Road, P.O. Box 7610

Madison, Wisconsin 53707-7610 - USA

**Tel:** 608-221-2261

**Fax:** 609-221-5810

**Web Page:** [www.warmanintl.com](http://www.warmanintl.com)

**Contact:** Julie Capadona

**E-mail:** [generalinfo@warmanintl.com](mailto:generalinfo@warmanintl.com)

**Western Environmental Services & Testing, Inc.**

913 Foster Road

Casper, Wyoming 82601 - USA

**Tel:** 800-545-5711, 307-234-5511

**Fax:** 307-234-8324

**Web Page:** [www.hawksindustries.com](http://www.hawksindustries.com)

**Contact:** James E. Meador, Jr.

**E-mail:** [west\\_wy@trib.com](mailto:west_wy@trib.com)

**Western States Mining Consultants, P.C.**

770 W. Collins, Suite 200

Casper, Wyoming 82601 - USA

**Tel:** 307-266-9117

**Fax:** 307-265-7086

**Web Page:** [www.westernstatesmining.com](http://www.westernstatesmining.com)

**Contact:** David H. Scriven, P.E.

**E-mail:** [wsmc@coffey.com](mailto:wsmc@coffey.com)

**Wheelabrator Air Pollution Control Inc.**

441 Smithfield Street

Pittsburgh, Pennsylvania 15222-2292 - USA

**Tel:** 412-562-7300

**Fax:** 412-562-7617

**Web Page:** [www.wapc.com](http://www.wapc.com)

**Contact:** Michael Kozy

**E-mail:** [mkozy@wapc.com](mailto:mkozy@wapc.com)

## References

- Hagler Bailly, Inc., Environmental Pollution Prevention Project (EP3). *Best Management Practices in Nonferrous Metals Mining and Processing*. September 1998.
- International Directory of Mining*. Engineering and Mining Journal. Interec Publishing Company, Chicago, IL, 1996.
- National Mine Land Reclamation Center. *Acid Drainage Technology Initiative*. White Paper, March 1998.
- Randol Buyer's Guide, 1995*. Published by Randol International LTD., Golden, CO, 1995.
- Rastogi, V. *Water Quality and Reclamation Management in Mining Using Bactericides*. Mining Engineering, April 1996.
- Society for Mining Metallurgy and Exploration Inc. (SME). *SME Resource Guide, 1998*. Littleton, CO, 1998.
- Tailings and Mine Waste '98, Proceedings of the Conference on Tailings and Mine Waste '98, Published by A.A. Balkema.
- Terms of Environment page. United States Environmental Protection Agency. June-July 1999. <<http://www.epa.gov/docs/OCEPAterms/>>.
- Thomas Register of American Manufacturers<sup>SM</sup>. 1999. <<http://www.thomasregister.com>>